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SNOW (D.) & WATTS (P. S.). **Storage of oilcakes. Experiments with sulphonamide E.O.S. and propamidine as preservatives.**—Reprinted from *Food (Hannah Dairy Res. Inst. Reprint 161)*, 3 pp., 1 fig., 2 graphs, 1945.

After pointing out that when feeding-stuffs have to be stored under unsatisfactory conditions, the relative humidity cannot always be maintained below the safe level of about 70 per cent., and that in such cases the use of a non-toxic preservative might increase the storage life, the authors describe experiments in which sulphonamide E.O.S. and propamidine were applied to linseed cake by (a) incorporating fixed amounts in ground samples, and (b) spraying 1 in. cubes of the cake with solutions in 80 per cent. ethyl alcohol. The samples were then stored in desiccators at 25° C.

The results showed that at humidities above 80 per cent. R.H. the drugs markedly inhibited moulds (*Penicillium* spp. and members of the *Aspergillus glaucus* group). With both methods of application the effect was most striking with sulphonamide E.O.S., which incorporated at a concentration of 0·2 per cent. more than doubled the storage life of samples stored at 85 and 80 per cent. R.H. The storage life of cubes sprayed with a 2 per cent. solution of sulphonamide E.O.S. was two to three that of the control cubes sprayed with alcohol alone, and three to four times that of the untreated cubes. With both methods of application propamidine was less effective than sulphonamide E.O.S. This was unexpected, as the former showed a greater fungistatic power than the latter in other workers' investigations.

Although both drugs are toxic, no ill effect need be expected from feeding oilcakes containing 0·2 per cent. sulphonamide E.O.S., since the normal therapeutic dose given orally for mastitis in dairy cows is 4 oz. a day for 14 days. If 5 lb. of cake containing 0·2 per cent. of the drug were consumed daily, the daily intake would be only $\frac{1}{25}$ of the normal therapeutic dose. By spraying a solution of the drug on to the surface of the cake (which is believed to be the better method), the amount ingested would be very much less.

These results warrant an investigation of the application of the drugs that should be carried out on a larger scale under commercial conditions.

SALLANS (H. R.), SINCLAIR (G. D.), & LARMOUR (R. K.). **The spontaneous heating of Flax seed and Sunflower seed stored under adiabatic conditions.**—*Canad. J. Res.*, Sect. F, xxii, 6, pp. 181–190, 4 graphs, 1944.

The spontaneous heating developed by various grains under certain moisture and storage conditions, known commercially as 'bin burning', is responsible for serious damage and, at an advanced stage, renders the products worthless. Flax and sunflower seed in an adiabatic thermostat with an initial temperature of 19·5 to 21°, rising to a maximum of 51 to 52° C., became heated in less than two months at moisture contents of 11·4 and 10·5 per cent., respectively, from which it would appear that the commercial limits of 10·5 and 9·5 per cent. set for these two grains are not too low. The acceleration in the over-all respiration rate of the two kinds of seed preceding heating indicates the active participation in the process of

proliferating micro-organisms, among which species of *Aspergillus* and *Penicillium* are believed to be represented, though no attempts at isolation or identification were made.

On the basis of these data, it is suggested that a relative humidity in excess of 74 per cent. of the interstitial air in bulk grain will promote microbial growth and resultant heating. Hence it follows that the moisture content of any grain, in equilibrium with air at a relative humidity of 74 per cent., will closely approximate the upper limit admissible for inclusion in 'straight' grades.

SMITH (K. M.) & MARKHAM (R.). **Importance of Potato virus X in the growing of Potatoes.**—*Nature, Lond.*, clv, 3924, pp. 38–39, 1945.

Of the three potato virus diseases important to the grower, leaf roll, severe mosaic (virus Y), and mild mosaic (virus X), the first two are not common in the best seed-growing parts of Scotland and being easily visible can be eliminated by roguing. The third, on the other hand, is present in a very high proportion of the best Scotch seed potatoes, not excluding those with a Stock Seed certificate, and probably including all the Scottish stocks of Kerr's Pink; except in a few varieties, such as King Edward and Epicure, it cannot be detected by inspection alone. To determine whether a potato plant is virus-free, inoculations must be made to indicator plants and grafting carried out to susceptible varieties. Very few Scotch seed potatoes will pass these tests.

There are in existence, however, at the Plant Virus Research Station, Cambridge, small stocks of potatoes completely free from virus disease, including Kerr's Pink, and up-to-date multiplication is being carried out in co-operation with the National Institute of Agricultural Botany. The nucleus virus-free stocks are grown in Northern Ireland [cf. *R.A.M.*, xxiii, p. 497]. As soon as sufficient tubers are raised, they are planted on the island of Islay, off the west coast of Scotland, where no other potatoes are grown. In about two years' time, several thousand tons of virus-free seed potatoes should be available. Samples are sent to Cambridge from Ireland periodically for testing, and in 1944, 1,500 tubers grown out of doors for three years were examined. The great majority were still virus-free, though a few tubers of one line of Majestic showed mild mosaic. There was reason to believe, however, that some of these tubers might have been infected before being despatched to Ireland. This and other evidence indicated that virus X spreads very slowly in the field.

J. R. Scott's investigations showed that negligible mottle reduced yields by 13 per cent., as compared with 'healthy' plants [*ibid.*, xx, p. 487], but as his 'healthy' plants were probably X-infected, his results actually correlate yield reduction with symptom severity. There would appear to be little doubt that the presence of virus X materially reduces yield, a view supported by Bald's recent work [*ibid.*, xxiii, p. 145; see also xxiv, p. 113].

A somewhat extensive yield trial was carried out at Cambridge with the potatoes from Ireland, all of which had been found virus-free. They were planted in 60 plots, each of four rows of ten half-tubers. Half the plants were inoculated with a very mild strain of virus X from stock seed Arran Peak. Some weeks later, 25 inoculated plants were selected at random and all were found to show the presence of virus X, though it was not possible during the summer to distinguish the inoculated plants from the others by inspection. When the tubers were harvested and weighed, the yield from the inoculated plants was 12 per cent. less than that of the virus-free plants, a highly significant difference. All varieties showed reduced yield as a result of the presence of X. These results seem to prove that infection by virus X, even by those strains which are normally passed over by the inspectors, results in considerable crop loss.

The elimination of virus X from Scotch seed potatoes would appear by no means

impossible. The solution seems to lie in a gradual replacement of the infected stock seed, and in this process it is hoped that the stocks built up by the Plant Virus Research Station in co-operation with the National Institute of Agricultural Botany may play a part.

ALLAN (J. A.). **Fluorescence in ultra-violet light as a test for the presence of leaf roll virus in Potato tubers.**—*Nature, Lond.*, clv, 3926, p. 116, 1945.

Cut surfaces of tubers from leaf-roll potato plants examined under ultra-violet light from a 230 v. 125 amp. 3-pin base bulb with a Wood's glass filter displayed varying amounts of fluorescence, which was most marked in the setts, where it appeared to extend throughout the medulla; it was more limited in distribution in tubers of the present season's growth, where it appeared to be confined to the vascular bundles. Cut tubers from healthy plants showed a much lighter colour on the cut surfaces than on the skin, but no fluorescence.

WILSON (A. R.) & BOYD (A. E. W.). **Potato wastage in clamps.**—*J. Minist. Agric.*, li, 11, pp. 507–512, 1 diag., 1945.

A very large tonnage of potatoes is lost every year in Britain in clamp storage, particularly after a wet autumn, such as that of 1944. Rain penetration, frost injury, or the inclusion of too many tubers affected by blight [*Phytophthora infestans*] may induce whole or partial collapse of the clamp. Tubers injured by frost, water-logging, or blight quickly become attacked by bacterial rots. The temperature in the clamp rises, and the carbon dioxide content of the atmosphere increases. These conditions may induce soft rots, with further increases in temperature, which sometimes reaches over 112° F. This heat greatly accelerates sprouting and loss of weight through evaporation, and may cause internal blackening of the tubers. If the start of such overheating could be observed by means of a clamp thermometer, it should be possible greatly to reduce losses by providing immediate ventilation. In the present year, when many clamps have, necessarily, been built with tubers not in the best condition, the use of clamp thermometers might save much unnecessary waste. These instruments appear to have been used in Germany for some years.

Blighted tubers become included in clamps in three ways. Quite obviously diseased tubers may be carelessly thrown in with sound ones, some, not apparently affected, may be unavoidably included, and, thirdly, the crop may be lifted with infection still active on the green haulms. Haulms should be burnt off at least ten days before lifting.

Whether the inclusion of blighted tubers in clamps conduces to collapse or not depends on many factors. The disease does not appear to spread from affected to sound tubers in the clamp. Small pockets of rotten tubers seem to result from localized areas of overheating, initiated by the decay of a few blighted tubers, followed by soft rots. If 25 per cent. (often fewer) of the tubers in a clamp are blighted, there is great danger of overheating and total collapse, though much depends on the amount of moisture present. In dry clamps, blighted tubers may remain free from soft rots and merely shrivel up.

Mechanical damage, one of the commonest sources of wastage, is often unnecessarily increased by faulty setting of the spinner and careless manipulation while clamping and dressing. Dry rot fungi (*Fusarium* spp.) readily gain entrance to susceptible varieties through wounds caused in this way.

Other causes of loss in clamps include mineral deficiencies in the soil, which induce serious forms of blackening, pink rot [*Phytophthora erythroseptica* and *P. megasperma*], watery wound rot [*Pythium ultimum*], and blackleg [*Erwinia phytophthora*], which may lead to considerable losses in individual instances, and common

scab [*Actinomyces scabies*]. This last may prevent the stocks from reaching standard, but secondary rots do not generally follow it, so that loss is never complete.

The chief precautions to take are (1) to exclude blighted tubers, (2) provide protection against frost and rain by using fresh, dry straw, if necessary, at earthing-up, (3) build the clamps so that they provide protection against inclement weather, and (4) watch for overheating in spring, and de-soil strips to permit cooling when this occurs.

ROEHL (L. M.) & KNORR (L. C.). **A rotary cutting knife to control the spread of Potato ring rot.**—*Ext. Bull. Cornell agric. Exp. Sta.* 660, 8 pp., 2 figs., 7 diag., 1944.

The best control of potato ring rot [*Corynebacterium sepedonicum*] is achieved by using each year new, disease-free seed after disinfecting the equipment and buildings, but this may not always be possible. The disease is chiefly spread by means of the knife used in cutting the tubers for seed purposes, and it has been established that the knife may be easily disinfected by dipping it into boiling water [*R.A.M.*, xxiv, p. 31]. The authors give detailed instructions for making an inexpensive motor-driven machine for cutting tubers for planting, by means of a rotary knife, capable of disinfection by passing the blade through a tank of water kept boiling electrically or otherwise. The machine can be set up with the tools and materials usually available on a farm at a cost of about \$20. Tests of the machine in 1943 and 1944 showed that as many as 49 bush. per acre were gained by its use in one experiment, a highly significant result.

LARSON (R. H.). **The ring rot bacterium in relation to Tomato and Eggplant.**—*J. agric. Res.*, lxix, 8, pp. 309–325, 3 pl., 8 figs., 1944.

Investigations on the relation of the potato ring rot organism (*Corynebacterium sepedonicum*) to the host tissues of tomato, on the development of the disease in tomato and eggplant, and on the host range of the organism are described. Inoculations made by dipping a needle point into a pure culture of *C. sepedonicum* from potato and inserting it directly into the vascular region of tomato plants, or by puncturing with a needle through a water suspension of the organism into the vascular tissue of the lower stem, demonstrated that *C. sepedonicum* may readily cause severe wilting and death of tomato plants. The organism was found to invade the plants systemically through the xylem, seldom affecting the adjacent phloem and parenchyma in the initial stages. The intercellular spaces of younger xylem tissues showed only slight enzymatic action in advance of the bacteria, and lignification and the formation of sclereids was not observed.

In infected mature fruit, the organism was traced from the invaded place of fruit attachment through the tracheae in the placental region and locular cavity directly to the funiculus of the seed. In the seed, the bacteria were found between the integument and endosperm in the micropylar region between the embryo and the endosperm. Seed transmission was demonstrated. All the tomato varieties tested were susceptible. Infection occurred in all tomato transplants when planted in soil recently infected with suspensions of bacteria. No infection occurred when tomatoes were planted in inoculated soil held throughout winter in the field. In all the commercial varieties of tomato inoculated systemic invasion occurred, and infection resulted in a typical necrotic or moribund stage.

All varieties of the common garden eggplant were ascertained to be susceptible, as was *Solanum integrifolium*, while Puerto Rican Beauty and selection E-12 were resistant.

While the disease has so far been reported in the field only on potato, the present work confirms the view that *C. sepedonicum* is not specific to this host.

SCHARFF (J. W.) & CATANEI (A.). **Champignons inférieurs isolés de l'humus obtenu à Alger par la 'méthode d'Indore'.** [Lower fungi isolated from the humus obtained at Algiers by the 'Indore method'.]—*Arch. Inst. Pasteur Algér.*, xxii, 3, pp. 162–165, 1944.

The following micro-organisms were isolated from May to August, 1943, from a compost heap in the garden of the Pasteur Institute, Algiers, prepared by Sir Albert Howard's 'Indore method': *Actinomyces aureus*, *A. griseus*, *A. exfoliatus*, *A. albus*, *A. olivochromogenus*, *Rhizopus arrhizus*, *R. reflexus*, *Mucor mucedo*, *Aspergillus fumigatus*, *A. flavus*, *A. nidulans*, *A. niger*, *A. candidus*, *Penicillium glabrum*, *P. chrysogenum*, *P. glaucum*, *P. rugulosum*, and *Hormodendrum* sp.

KEYWORTH (W. G.). **Diseases of Hops.**—*Rep. E. Malling Res. Sta.*, 1943, pp. 28–29, 1944.

Since *Verticillium* wilt of hops [*V. albo-atrum* and *V. dahliae*: *R.A.M.*, xxiii, p. 2] was first discovered in 1924 [*ibid.*, v, p. 278], 150 outbreaks have been recorded at East Malling, of which 67 were noted in 1943. That this latter number is so large is due partly to the fact that many long-standing outbreaks of a mild type were reported during a Ministry of Agriculture inspection of hop gardens from which cuttings were to be taken. The disease continues to spread from old-established centres. Soil disinfection as carried out in commercial practice appears to be of doubtful value in the control of large outbreaks, but more intensive methods are still recommended for small ones. Two commercial experiments demonstrated that the application of large quantities of dung or sulphate of ammonia had no effect on incidence in badly affected areas. In a preliminary test on artificial soil infection in two districts, disease intensity, as estimated by the number of affected plants and the severity of the symptoms, was much greater in one than in the other. This appeared to be due to differences in the soil conditions.

Resistance tests of the Wye seedling varieties were continued, and seven varieties were selected as showing high resistance in their first two years' tests; brewing tests demonstrated that at least three of these are commercially acceptable.

MCMARTIN (A.). **Three-years old Cane and the health of the crop.**—*S. Afr. Sug. J.*, xviii, 10, p. 421, 1944.

Field observations at Eshowe, Natal, having suggested an increased incidence of red rot [*Phylospora tucumanensis*: *R.A.M.*, xxiii, p. 149; xxiv, p. 120] in plantations where the previous crop had been cut as cane over two years old, resulting in a heavy drop in the tonnage (from 37.1 to 4.9 tons per acre in one case), a trial was carried out at the Experiment Station, Mount Edgecombe, to verify this supposition. Two small plots of Co. 290, very slightly infected by red rot at two years old (in 1943) were left standing till 1944 to ascertain whether the first ratoon crop would show any substantial increase in the disease over other plots cut at two years old as plant cane. At the same time, two plots of Co. 331 adjacent to the Co. 290 were similarly treated. On cutting, the sticks were divided into three groups, namely, (a) dead, these being too dry for the diagnosis of any particular disease, but as they showed two seasons' growth and had evidently flowered in 1943, they must have been third-year canes; (b) canes showing two seasons' growth, most of which were healthy; and (c) those in their first year, all sound. The two plots of Co. 290 contained in all 329 canes of group (a), 421 of (b), and 274 of (c), the corresponding figures for Co. 331 being 408, 469, and 378, respectively. The sucrose contents and purity of groups (b) of Co. 331 were 13.13 and 90.6 per cent., respectively, and those of (c) 13.52 and 91.3, respectively, the corresponding figures for Co. 290 being for (b) 14.48 and 90.6 and for (c) 15.25 and 87.1 per cent., respectively. A neighbouring two-year-old plot of Co. 331 was found to have a sucrose content of 13.78 and purity of 91.2 per cent.

It is apparent from these data that the elimination of unsound sticks from crops of three-year-old cane would ensure a supply of reasonably high-quality material for milling, but the question arises of the wisdom of leaving large numbers of diseased sticks in the field for a sufficiently lengthy period to add considerably to the reservoir of inoculum available for the infection of the new crop. As an alternative to the practice of cutting the cane at two years, which is decidedly preferable from the hygienic standpoint but may be impracticable without a readjustment of the present system, dead and diseased canes should be collected in heaps and burnt.

D[ODDS] (H. H.). **Experiment Station notes.**—*S. Afr. Sug. J.*, xxviii, 9, 367–369, 371; 11, pp. 467, 469, 471, 1944.

Included in these notes [cf. *R.A.M.*, xxiii, p. 148] are reports from the Botanist [A. McMartin], incorporating the following information. Specimens of diseased sugar-cane leaves received from Sena Sugar Estates, Portuguese East Africa, were ascertained to be infected by smut [*Ustilago scitaminea*].

Mosaic was detected on the promising N.Co. 339 variety, and streak on N.Co. 326, the former also being attacked by *Cytospora sacchari*, which is new to South Africa.

Aretan (0.5 per cent.) has proved almost equally effective with ceresan in the control of pineapple disease [*Ceratostomella paradoxa*: *ibid.*, xxii, p. 453], and is simpler and more economical in use than the latter. These two preparations are the only organo-mercurials at present available in the country.

RENDLE (B. J.). **Nomenclature problems of the applied biologist.**—*Nature, Lond.*, cliv, 3922, pp. 812–814, 1944.

This is a summary of the discussion on practical problems of botanical and zoological nomenclature held at a meeting of the Association of Applied Biologists on 10th November, 1944. Those taking part included J. Ramsbottom, G. R. Bisby, B. J. Rendle, A. Roebuck, I. Thomas, and F. Hemming.

JENKINS (ANNA E.). **Two new records of Sphaceloma diseases in the United States.**—*Phytopathology*, xxxiv, 11, pp. 981–983, 1 fig., 1944.

In July, 1943, specimens of *Aralia spinosa* leaves infected by scab (*Sphaceloma araliae*), hitherto known only from Maryland [*R.A.M.*, xvii, p. 203], were received through C. M. Tucker from a north-eastern Missouri nursery.

S. murrayae [*ibid.*, xxiii, p. 48] was collected in the following month on *Salix lasiandra* foliage in Washington, this being the first record of the fungus for the State and for this host species. Commenting on the geographical distribution of willow scab, C. R. Ball points out that the causal organism is now known to occur on five species of *Salix* belonging to four sections of the genus. It has been collected in four continents, represented by New Zealand, Latvia, Argentina, and the United States. Nearly all the localities reported to date as habitats of *Sphaceloma murrayae* are either on the coast or within reach of maritime influences. These facts, considered in conjunction, are thought to indicate a wider host and geographical range than has yet been established for the pathogen.

SOLHEIM (W. G.). **Mycoflora saximontanensis exsiccata. Centum IV.** [Exsiccata of the Rocky Mountain mycoflora. Fourth hundred.]—*Univ. Wyo. Publ.* (formerly *Univ. Wyo. Publ. Sci.*), x, 4, pp. 33–46, 1943.

Three new species and a number of parasitic fungi are included in this list of fungi collected in the Rocky Mountains between 1929 and 1932.

COOKE (W. B.). **Notes on the ecology of the fungi of Mount Shasta.**—*Amer. Midl. Nat.*, xxxi, 1, pp. 237–249, 1944.

In this paper the author discusses the ecology of the fungi found on Mount

Shasta [northern California] under the main headings of biological factors (morphological and physiological aspects and methods of spore disposal), ecological factors (lack of correlation with life zones, snow-line fungi, and host restriction), the ecological classification of the fungi, and their geographic relationships. In his view, the distribution of fungi is primarily controlled by their adaptability to hosts and substrata, regardless of the relationship of the hosts to each other and their altitudinal distribution. The paper concludes with a table recording 154 genera of fungi, including 274 species, and 358 records of saprogenic and pathogenic activity on more than half of the nearly 500 known species of vascular plants on Mount Shasta. The elevations at which the hosts occur are given and their annual or perennial habit indicated.

RYJKOFF (V. L.), VOVK (A. M.), & ALEXEEVA (MME T. S.). **On the physiological peculiarities of the yellow strain of Tobacco mosaic virus.**—*C. R. Acad. Sci. U.R.S.S.*, N. S., xlii, 2, pp. 84–86, 1 fig., 1944.

The detection of some sharply defined light yellow spots in tomato plants infected with tobacco mosaic led to the isolation of a virus considered to be a yellow strain of the tobacco mosaic virus [*R.A.M.*, xxiii, p. 460], very similar to the white strains. In tomato plants, inoculation with juice from such spots resulted in an abnormally severe form of mosaic, characterized by yellow or nearly white spots on the youngest leaflets with subsequent lack of chlorophyll in the leaves, depression in growth of the whole plant, and dying-off of parts of leaves or entire leaves. In tobacco plants, inoculation resulted in a yellow mosaic of a somewhat unusual pattern followed by necrosis and dying-off of the leaves. The cells of plants infected with the yellow strain contain typical hexagonal Iwanovsky crystals. Tobacco plants infected with the green strain of the virus defied infection with the yellow strain and vice versa; while in the case of tomato plants neither strain was entirely suppressed by the other. The yellow strain was inactivated by a temperature of 86° C. and the green strain by one of about 90°. The yellow strain was inactivated by a hydrogen peroxide concentration of 0.15 per cent. while the green strain was not completely inhibited by any within the range of between 0.01 and 0.15 per cent. When halves of the same tobacco or tomato leaf were inoculated with juice containing either the yellow or the green strain, it appeared that the green strain always accumulated at a higher rate than the yellow one, and particularly so in tomato.

SOUKHOV (K. S.). **Salivary secret of the aphid *Myzus persicae* Sulz. and its ability to form a filtering apparatus.**—*C. R. Acad. Sci. U.R.S.S.*, N.S., xlii, 5, pp. 226–228, 1 fig., 1944.

After describing the process of penetration into plant tissue by the aphid *Myzus persicae* and the manner in which it receives the vegetable sap in a filtered state without any suspension of solid particles, the author states that the stylet of the vector, when inserted into cells containing virus inclusions, does not induce solution of the crystals, even in the case of contact. This circumstance is taken to explain the inability of the aphid to transmit the virus of tobacco mosaic.

WALKER (E. A.) & MCINROY (SARAH W.). **Tobacco anthracnose, a new Tobacco plant bed and field disease.**—*Abs. in Phytopathology*, xxxiv, 11, p. 993, 1944.

Tobacco anthracnose assumed the form of a leaf spot in commercial seed-beds in May, 1941, near Waldorf, Maryland, and in the following year it was very destructive on crops in poorly drained soils. In the seed-bed infection occurred in the shape of foliar spots, seedling blight, and cankers on the midrib, petiole, and stem, the last-named symptom extending in the field to the branches of the flower head and the seed pods. The disease was found to be readily transmissible by means of contaminated seed. The pathogenicity of a species of *Colletotrichum* consistently

isolated from leaf spots and stem cankers was established. Sectors of the fungus in culture gave rise to a *Gloeosporium*, which was also obtained from diseased tobacco plants. Some strains of both organisms produced spiral growth on certain media.

YOUNKIN (S. G.) & DIMOCK (A. W.). **Foliage infections of *Lycopersicon esculentum* by *Colletotrichum phomoides*.**—*Phytopathology*, xxxiv, 11, pp. 976–977, 1 fig., 1944.

Rutgers, Marglobe, Early Baltimore, John Baer, Chicago, and Garden State tomato seedlings, inoculated with suspensions of spores, sclerotia-like bodies, and mycelium of *Colletotrichum phomoides* [*R.A.M.*, xxii, pp. 157, 502, and next abstract], which is generally believed to be confined to the fruits, developed in five to seven days a necrotic spotting of the leaflets and cotyledons, the latter being involved to the extent of a quarter to a third before abscission. The lesions on the under sides of the leaflets were sunken, owing to the collapse of the mesophyll, and surrounded by a chlorotic halo; they attained a maximum diameter of 2 mm. Each lesion harboured spores of *C. phomoides*, generally only two or three, though in some cases they were present in larger numbers. In one trial at the Riverton (New Jersey) laboratory, all the 240 plants inoculated contracted the disease, the number of leaf spots ranging from four to 198 per plant. The fungus was recovered from the infected tissues of 28 out of 30 leaflets planted out on potato dextrose agar and reinoculated into tomato seedlings with positive results. In another trial, 12 out of 14 cotyledonary lesions, 18 out of 20 from leaflets with necrotic spots, and 18 out of 20 from leaflets with diseased tips yielded the pathogen on the same medium.

MCNEW (G. L.). **Control of anthracnose on cannery Tomatoes.**—*Canner*, xcvi, 25, pp. 21–22, 46, 48, 50, 3 figs., 1944.

Anthracnose or ripe rot (*Colletotrichum phomoides*) [see preceding abstract], admittedly the most important disease of tomato fruits, appears to be increasing in intensity, being most destructive in the Tri-State area of the Atlantic seaboard and also causing substantial reductions in Indiana, Ohio, and western New York. A remarkable feature of the pathogen is the extensive loss resulting from even a moderate incidence of infection, which is usually under 30 per cent. The cost of picking is doubled or even trebled by the presence of only 5 or 10 per cent. infection, since each fruit must be carefully examined on all sides, while the cost of processing is raised by the additional sorting and trimming required. Even more serious is the waste of pulp on account of high mould content when healthy fruits are contaminated through contact with diseased ones. Half-a-dozen severely infected fruits in a bushel basket may unfit the entire lot for human consumption according to the stringent Government regulations now in force. Anthracnose may completely upset factory operations before its presence is detected, as in 1941, when the admixture with sound fruits of diseased fruits from an area of six acres (less than $\frac{1}{2}$ per cent. of the total) imperilled the crop from the entire locality until the source of the trouble was located and the suspected material set aside for special sorting.

The life-history of *C. phomoides* is somewhat obscure, and even the environmental conditions needed for its development have not received sufficient attention. Circumstantial evidence definitely points to the overwintering of *C. phomoides* on diseased plant refuse in the field, and further suggests its transmission through the seed. Crop rotation and hot-water treatment of the seed should therefore be practised as precautionary measures. Anthracnose makes a sudden appearance and disappears with equal rapidity. It is sometimes limited to a single picking or to one section of a field, and frequently occurs with particular virulence on plants enfeebled by defoliation diseases.

C. phomoides is not amenable to control by improved cultural practices alone, and experiments have therefore been carried out to determine the relative efficacy

for this purpose of various new fungicides in comparison with Bordeaux mixture 4-2-50. In September, 1942, the disease developed in two fields of the John Baer variety in Wayne County, New York, where tests were already in progress against leaf blight [*Septoria lycopersici*]. The incidence of anthracnose (average of four trials) in the plots sprayed five times with Bordeaux, fermate (2-100), copper oxychloride sulphate (4-100), and left untreated was 9.8, 2.9, 12.9, and 16.6 per cent., respectively, and the corresponding yields of marketable fruit per acre 30,284, 29,021, 31,116, and 23,701 lb., respectively. In a further experiment in Ontario County, New York, in which four applications were given of sulphur (5-100), tribasic (4-100), fermate (2-100), and Bordeaux (4-2-50), the average (three tests) incidence of anthracnose was 16, 25.1, 1.4, and 13.7 per cent., compared with 32 in the untreated plot. The disease developed exclusively on fruit ripening between 13th and 25th September.

The percentage of fruits attacked is not the only way of measuring the severity of anthracnose infection. To the processor, the primary consideration is the amount of fungal growth in the fruit, and from this standpoint fermate did much more than reduce the incidence from 32 to 1.4 per cent., the former representing thousands of spots (20 to 80 on each fruit on many plants), and the latter three or four, mostly less. As regards the mould content of the fruit, fermate probably lowered the proportion from between 300 and 600 units to one—an immensely important factor in relation to the high standards imposed by the existing regulations referred to above.

Before fermate can be generally recommended, however, for anthracnose control, further tests must be made in different localities and during other seasons. Moreover, since it fails to control foliar diseases, a spray schedule combining fermate with the copper compounds will have to be developed.

McKAY (R.). Outbreaks of *Verticillium* wilt in newly-erected glasshouses.—*Gdnrs' Chron.*, Ser. 3, cxvii, 3030, p. 24, 1945.

In this communication from the Department of Plant Pathology, University College, Dublin, the author states that in the autumn of 1939 he found *Verticillium albo-atrum* [*R.A.M.*, xxiv, p. 89] prevalent in a tomato house which two years before had been built over an old rhubarb plantation. Formaldehyde treatment reduced infection to negligible proportions. In May, 1940, and again in 1943-4, other outbreaks of the disease [details of which are given] occurred in tomato houses erected over old rhubarb plantations.

All the evidence pointed to the rhubarb roots as the source of infection in the three houses. Infection of rhubarb roots by *V. albo-atrum* can be quite prevalent without being very conspicuous, as permeation of the entire root-stock is seldom thorough enough to cause complete wilt of the whole foliage. Occasional leaves on the crown may be killed, but these are seldom noticed. The only previous records of *Verticillium* on rhubarb appear to be those of Wormald [*ibid.*, viii, pp. 153, 154, 546]. While the erection of tomato houses on rhubarb plantations is probably not very common, rhubarb stools are often brought into propagating houses and occasionally into tomato houses for forcing. The disease may thus easily be introduced on broken pieces of rhubarb which get into the soil.

POMERLEAU (R.). Observations sur les chancres des arbres dans le Québec. [Observations on tree cankers in Quebec.]—*Abs. in Trans. roy. Soc. Can.*, Ser. 3, xxxviii, p. 164, 1944.

Various species of *Nectria* are the principal agents of cankers in broad-leaved trees in Quebec. The parasitism of the following fungi was demonstrated for the first time: *Poria punctata* on red oak [*Quercus coccinea*], *Diatrype macounii* on sugar maple [*Acer saccharum*], *Pholiota adiposa*, *P. squarrosoides*, and *Polyporus* [*Poly-stictus*] *pergamenus* on bird cherry, and *Stereum hirsutum* on beech. New hosts for

Hypoxyylon blakei are red oak and beech, for *Eutypella parasitica* [R.A.M., xxii, p. 183] bird cherry, and for *Schizoxylon microsporum* elm. The following percentages of trees were found to be infected by cankers in the Duchesnay Experimental Forest: sugar maple 13·3, red maple [*A. rubrum*] 16·7, bird and Pennsylvania cherries 12·3 and 12, respectively, beech 18·7, and aspen [*Populus tremuloides*] 2·9.

ARK (P. A.). **Further evidence of pollen dissemination of Walnut blight.**—Abs. in *Phytopathology*, xxxiv, 10, p. 933, 1944.

In the spring of 1944, many recently pollinated walnuts on both Bordeaux-sprayed and untreated trees in California were completely blighted by *Phytonomas* [*Xanthomonas*] *juglandis* [R.A.M., xxiii, p. 415 and next abstracts], foliar infections and hold-over lesions being absent in the majority of cases. Virulent cultures of the pathogen were yielded by wash water from externally healthy leaves and nuts in the affected orchard. Young Northern California black walnuts at a distance of 25 to 50 ft. from blighted Payne trees bore numerous infections on the foliage from the tree top to the ground line, but again no cankers or diseased buds could be detected. It is therefore assumed that the form of blight under observation is induced by the presence on the leaves of an abundance of contaminated wind-borne pollen originating in the partially blighted catkins of the susceptible Payne variety.

RUDOLPH (B. A.). **The Walnut erinose mite a carrier of Walnut blight.**—Reprinted from *Diamond Walnut News*, 1943, November, 1 p., 2 figs., 1943. [Received December, 1944.]

The variable results obtained in spraying for the control of walnut blight [*Xanthomonas juglandis*] under comparable conditions in California [see preceding abstract] led to an investigation of the possibility of insect dissemination of the disease. Flies, bees, ants, and other insects have been observed colonizing the black, shiny exudate from the lesions, but only two are known to be obligate parasites of the walnut, viz., *Chromaphis juglandicola* and *Eriophyes tristriatus* var. *erinea*, of which the latter, passing the winter in the adult stage, is more likely to act as a vector of *X. juglandis*. In the late summer of 1942, the pathogen was isolated on beef agar from a mite found hibernating beneath the scales of a healthy winter bud and inoculations carried out on seedlings in the greenhouse and on fully grown trees gave positive results. Should the mite be shown by further tests to be a major factor in the spread of blight, the existing spray schedule may have to be broadened to include treatment against this pest, for which the programme now in use does not provide.

SCOTT (C. E.). **Walnut blight today. Difficulties of control explained.**—Reprinted from *Diamond Walnut News*, 1944, March, 1 p., 1944.

Bordeaux mixture 8-4-50, though effectively protecting walnuts from the female flower stage onwards against infection by the overwintered blight [*Xanthomonas juglandis*] bacteria [see preceding abstracts], is open to the grave objection of impairing the quality of the product through foliar injury. Red copper oxide, with which the next best results have been secured, is free from this drawback, but for several years only the yellow form (cuprocide) has been available, and this has now been mostly appropriated for Government use. The problem confronting growers, however, will not be solved even by the development of a 'perfect' spray, since the repeated treatments necessary for complete blight control in rainy seasons would be uneconomic. Investigations concerned with improved remedial measures should therefore not only be directed towards the discovery of a superior bactericide, but also aimed at a reduction of the reservoir of inoculum within the tree.

FOWLER (M. E.) & STEVENSON (J. A.). **A canker and some decay fungi on Mimosa.** — *Phytopathology*, xxxiv, 11, pp. 985–986, 1 fig., 1944.

The branches of mimosa (*Albizia julibrissin*) trees recently inspected in the District of Columbia bore numerous cankers, which had invariably originated at the base of a dead twig, indicating that the causal organism, *Nectria cinnabarina*, can probably infect the healthy tissues only through an adjacent necrotic portion. The Washington district is near the northern limit for the successful cultivation of mimosa, and winter injury was no doubt a contributory factor in the establishment of the pathogen. *A. julibrissin* appears to have only twice previously been reported as a host of the canker fungus, in Virginia (*Plant Dis. Repr.* xvi, p. 138, 1932) and North Carolina (*ibid.*, xxiii, p. 85, 1939), but specimens of the disease were collected in South Carolina and Maryland in 1938 by members of the Division of Forest Pathology.

Five species of root-rotting fungi were also concerned in the decline of the trees, viz., *Polyporus* [*Polystictus*] *versicolor*, *P. hirsutus*, *Polyporus tulipiferus*, *Stereum albobalium*, and *Schizophyllum commune*, all apparently new records on *A. julibrissin*. *Entypella stellulata* occurred in profusion on dead twigs and branches.

STARKER (T. J.). **Preservative treatment of fence posts: 1943 progress report on the Post Farm.** *Bull. Ser. Ore. Engng Exp. Sta.* 9E, 4 pp., 1 graph, 1944.

On 28th October, 1943, 42 of the posts on the 'farm' for the trial of wood preservatives at the Oregon State College [*R.I.M.*, xx, p. 188] failed to resist the standard test of a 50-lb. pull applied 2 ft. above the ground, compared with 49 in 1942. No failures have occurred to date among the posts given the salt treatment [one tablespoonful of mercuric chloride and common salt in a $\frac{3}{4}$ in. hole bored at ground-level], though some are badly decayed above the site of insertion. The greatest regularity of annual failures over a 14-year period has been exhibited by the white fir [*Abies concolor*] group, the last two of which succumbed in 1943. In the group composed of western white, sugar, and ponderosa pines [*Pinus monticola*, *P. lambertiana*, and *P. ponderosa*], western larch [*Larix occidentalis*], and western hemlock [*Tsuga heterophylla*], all the 25 posts of the first-named species were found to have rotted, its average life being only 69 months, while the failures among *T. heterophylla*, larch, *P. ponderosa*, and *P. lambertiana* numbered 24, 22, 21, and 19, respectively. All the salt-treated lodgepole pine [*P. contorta*] posts are still sound, while of the untreated dead and live posts of the same species, 17 and 24, respectively, failed during a five-year period.

NARAYANAMURTI (D.) & PANDE (J. N.). **Note on sap stain and its prevention.** — *Indian For. Leaf.*, N. S., Utilis., 68, 11 pp., 1 fig., 1 graph, 1944.

Among the Indian timbers particularly liable to develop sap stain (*Ceratostomella* spp., etc.) under conditions favouring mould growth, including a moisture content exceeding 20 per cent. and a temperature ranging from 23° to 30° C. in the place of storage, are *Bombax malabaricum*, *Ailanthus* and *Erythrina* spp., *Moringa pterygosperma*, *Boswellia serrata*, *Treulia nudiflora*, *Anthocephalus cadamba*, *Sterculia campulanata*, and *Vateria indica*. It is advisable to store logs of these species under water, in which the staining organisms cannot grow owing to lack of oxygen, but where this is impracticable, an end coating may be applied, within 24 hours of felling, consisting of cresylic acid and filled hardened gloss oil (1:10), the entire log being sprayed with cresylic acid and paraffin or crude oil in the same proportions. In preservative experiments with various chemical compounds on *Bombax malabaricum*, *Ailanthus grandis*, *E. suberosa*, and *M. pterygosperma*, 1 per cent. santobrite and 0.25 per cent. lumbasan gave the most effective control. Sap-staining fungi do not appreciably impair the strength of the timber, but their presence is an indication

of poor handling and seasoning practice, and is objectionable, moreover, in all cases where the ornamental qualities of the grain are a primary consideration.

RAMSEY (G. B.) & WIAN (J. S.). **Market diseases of fruits and vegetables : Beets, Endive, Escarole, Globe Artichokes, Lettuce, Rhubarb, Spinach, Swiss Chard, and Sweet Potatoes.** *Misc. Publ. U.S. Dep. Agric.* 541, 40 pp., 17 pl. (7 col.), 1944.

This publication is the ninth in a series designed to aid in the recognition and identification of economically important pathological conditions affecting fruits and vegetables intended for the market, to facilitate the inspection of these food products, and to prevent losses from such disorders [cf. *R.A.M.*, xxi. p. 316].

Plant diseases. Notes contributed by the Biological Branch. *Agric. Gaz. N.S.W.*, lv, 11, pp. 493-498, 8 figs., 1944.

The virus disease of carrots recently described from Victoria [*R.A.M.*, xxiv, p. 134] has also been found in New South Wales, where it has probably been long established.

A certification scheme which aims at providing French bean seed free from bacterial blight (*Bacterium* [*Pseudomonas*] *medicaginis* var. *phaseolicola*) and scald and containing not more than a very small proportion of mosaic and anthracnose [*Colletotrichum lindemuthianum*] has been introduced into New South Wales. The regulations [which are listed] state that only approved varieties, such as Tweed Wonder, Canadian Wonder, Wellington Wonder, Hawkesbury Wonder, and Brown Beauty (Premier), are eligible for certification. The inspectors are to reject the whole of any crop in which bacterial blight is detected. A tolerance of not more than 5 per cent. mosaic and 1 per cent. anthracnose at the final inspection may be allowed, while not more than 3 per cent. impurities will be permitted. Applications for inspection may be rejected if the soil on which the crop is growing is one apt to induce the non-parasitic disorder termed 'scald' [ibid., xxii, pp. 91, 339].

The first symptom of scald is a collapse of the tissue between the main veins and along the edges of the leaflets. The collapsed tissue is light greenish-brown, later yellowish-brown. Withering of the tips or edges of the leaflets or of whole leaflets may ensue, giving the plants a blighted appearance. The affected plants are stunted, their yield is poor, and if many are affected crop failure may result. The disorder is associated with seed raised and sown in highly acid soils (P_H 4.2 to 5). Similar seed, if planted in fertile soils of low acidity, will give vigorous, productive plants. Affected plants have a manganese content several times that of healthy ones. The disease may be avoided on land known to be affected, by planting with seed raised on non-acid soils. Heavy applications of dolomitic lime some months before sowing is worthy of trial.

LYNES (F. F.). **The use of chloropicrin for Beet-seed warehouse fumigation and other purposes.**—*Proc. Amer. Soc. Sug. Beet Technol.*, 1942, pp. 413-421, 1943.

During the past three years, the author has successfully used chloropicrin at the rate of 2 to 8 c.c. per sq. ft. for the sterilization of greenhouse soil [*R.A.M.*, xxiii, pp. 114, 373]. The amount required appears to vary with the organic content of the soil, more being needed as the organic material increases. In most cases, it was applied when the moisture content of the soil was such that the soil was, culturally, in an optimum working condition, at the rate of 6 c.c. per injection, to a depth of 8 in., at points 20 in. apart in 10 in. rows, the soil surface being watered immediately to prevent rapid escape of the gas. This method controlled harmful soil micro-organisms (including *Phoma* sp., *Stemphylium* sp., and *Fusarium* sp., as shown by cultures from diseased sugar beets), and insects. As small concentrations of the gas are toxic to living plants, none are left in the greenhouse during treatment. Applications are made in the evening, the building remaining tightly closed overnight.

Planting is effected two weeks after the treatment. Heavier soils may have to be worked to allow the gas to escape. The cost is about \$12 per 1,000 sq. ft. If a gas-impervious paper is used instead of a water-seal, a smaller amount of the material may be found equally effective.

COONS (G. H.) & KOTILA (J. E.). **Advances in Sugar-Beet seed treatment.**—Abs. in *Phytopathology*, xxxiv, 11, pp. 990–991, 1944.

Finely ground mercuric chloride (in equal parts with copper carbonate and urea), mercuric iodide, 2 per cent. ceresan, new improved ceresan, and other organic mercury compounds have proved generally superior to copper carbonate or cuprous oxide for the disinfection of beet seed-clusters. Used in a ratio of 1:1 with copper carbonate, 2 per cent. ceresan often conferred more effective and durable protection against damping-off than when applied alone. Preparations giving satisfactory results with whole seed were similarly efficacious with sheared [*R.A.M.*, xxiv, p. 85], which responded favourably, for instance, to dusting with arasan or spergon, the latter, however, requiring a heavier dosage than that ordinarily recommended. ‘Pelleting’ of the seed is under trial as a means of securing precision in the planting of sheared material, to which standard pill-making techniques are applied to obtain a heavier seed unit of more uniform dimensions. To the coating may be added a fungicide, nutrient, or other substance tending to enhance damping-off control.

CARLSNER (E.). **Black streak, a bacterial disease of Sugar Beet in the Pacific Northwest.**—Abs. in *Phytopathology*, xxxiv, 10, pp. 933–934, 1944.

Sugar beets in parts of northern California, western Washington, and the Willamette and Rogue River valleys of Oregon have been suffering of recent years from a bacterial disease involving the leaf blades, petioles, and seed stalks, on which dark brown or black streaks develop. The agent, probably identical with *Bacterium aptatum* [*Pseudomonas aptata*: *R.A.M.*, xv, p. 139], appears to enter the plants through hydathodes and wounds, often invading the tissues damaged by downy mildew [*Peronospora schachtii*]. Field observations suggest the possibility of its transmission through the seed. So far, black streak has not contributed appreciably to the reduction of yields.

MILBRATH (J. A.). **Studies on the control of Bean rust.** Abs. in *Phytopathology*, xxxiv, 10, p. 936, 1944.

In one district of Oregon where Blue Lake pole beans are extensively grown, rust [*Uromyces appendiculatus*] is of sufficient importance to justify the institution of a control schedule. The pathogen probably overwinters by means of teleutospores, large numbers of which may be found adhering to the used stakes. When contaminated stakes were placed with beans growing in cages in the greenhouse, numerous pycnidial pustules developed in three to four weeks, while unstaked plants remained healthy. The immersion of contaminated stakes in lime-sulphur 1 in 10 or copper sulphate 8 in 100 prevented infection from this source. Weekly applications of kolodust, commencing before aecidiospore formation, were also very effective in combating the disease.

HEWITT (E. J.). **‘Marsh spot’ in Beans.** *Nature, Lond.*, clv, 3923, pp. 22–23, 1 fig., 1945.

When peas, broad beans, runner beans, and French (dwarf) beans were grown at Long Ashton in manganese-deficient sand cultures and the pods left on the plants until dry, the seeds showed typical, severe marsh spot [*R.A.M.*, xxi, p. 179] in the case of the peas, a mild to severe marsh spot type of symptom in the broad and runner beans, and no sign of the disease in the case of the dwarf beans. Typical

leaf symptoms were present on runner and dwarf beans, and numerous pods failed to fill after setting.

In a field trial in 1943, peas and broad beans growing in an acutely manganese-deficient market-garden soil showed mild to severe symptoms of the marsh-spot type. In 1944, similar material showed severe marsh spot in peas and mild symptoms in beans. Runner, dwarf, haricot, and tick beans showed no symptoms in the cotyledons. Typical leaf symptoms were severe in dwarf and haricot beans. Spraying the leaves with an aqueous solution of manganese sulphate (0.25 per cent. solution of $\text{MnSO}_4 \cdot 4\text{H}_2\text{O}$) prevented and cured the leaf symptoms.

The results obtained showed that while peas are very susceptible to manganese deficiency as shown by marsh-spot symptoms, broad and runner beans are more resistant; dwarf and haricot beans, which show the most conspicuous leaf symptoms, are most resistant, and may remain otherwise unaffected even when they present severe leaf symptoms.

TRUSCOTT (J. H. L.). **A storage rot of Celery caused by *Ansatospora macrospora* (Osterw.) Newhall.**—*Canad. J. Res.*, Sect. C, xxii, 6, pp. 290-304, 2 pl., 1944.

The symptoms of a storage rot of celery (*Ansatospora macrospora*) [*R.A.M.*, xxiii, p. 324] grown in muck soil near Thedford, Ontario, are described as follows. Lesions may occur in any part of the plant, but those on the petioles and leaf blades have been noted only late in the storage season, in the last stages of the senescence of the celery. The lesions, which cause over 95 per cent. of the total damage, develop on the tap-root, beginning at the surface and growing inwards and upwards until the attachments of the leaf petioles are entirely rotted away. There may be one to many lesions on the tap-root; they are at first brown, later turning dark green, and finally almost black. Observations made over a period of ten years showed that damage may range from nil to complete destruction. Losses are usually small during the first two months of storage, increasing with time and reaching a maximum within four months.

Pure cultures of the causal fungus are obtained readily from the inner parts of a lesion if it is laid open with a hot knife. Cultures on potato dextrose agar form concentric rings of green and red as the colony grows. The colour is usually green at about 65° F. and red between 80° and 90°. The optimum temperature for growth is between 55° and 65°. Strains of the fungus were isolated that varied greatly in pathogenicity when inoculated into celery stored at 32°; they also varied in growth rate on artificial media and even somewhat in their gross appearance; some strains tended to develop a red colour at all temperatures. Various methods recommended by Newhall [loc. cit.] failed to induce sporulation in both an old and a new culture. It appears established beyond doubt that the fungus is present on or in the celery when it is placed in storage, but it is still not clear whether in the form of mycelium or spores. The fungus appears to be indigenous to Thedford muck soil, developing with about equal severity in celery grown in all fields of the district. The disease does not appear to spread from plant to plant during storage except in very badly rotted celery. It has so far not been possible to find any source of infection other than the soil in which the celery is grown. There is evidence that the disease is connected with senescence of celery. It is a point of practical importance that the first symptoms generally appear only after about eight weeks in storage, towards the end of December, and that Thedford celery sold before that time would suffer little loss from the disease. It was observed that varieties of celery whose general condition was maintained best tended to develop the rot in serious proportions at a later date than those that became senile more quickly. It is pointed out in this connexion that the non-appearance of the disease on celery from the wet field during ordinary storage periods may be a function solely of its maturity.

The only effective control measure so far found is dipping the butts of celery to a

depth of about 1 in. into a 1 in 4,000 watery mixture of phenylmercuric acetate at packing time. Treatment of diseased heads with this chemical reduced the percentage of affected heads in the crates to between 0.4 and 3.8 (examined between the months of January and March) as compared with between 18 and 100 on the untreated lots. The treated heads bore only a few small lesions and 90 per cent. of them were saleable, while the untreated ones were largely unmarketable.

COX (C. E.). **The response of Cantaloup-Cucumber grafts to inoculation with *Fusarium bulbigenum* var. *niveum* f. 2.**—Abs. in *Phytopathology*, xxxiv, 11, p. 991, 1944.

Cucumbers are not susceptible to cantaloupe wilt (*Fusarium bulbigenum* var. *niveum* f. 2) [*R.A.M.*, xxii, pp. 65, 125]. In grafting experiments with (a) cantaloupe scions on cucumber stocks, (b) reciprocals, (c) cantaloupe scions on cantaloupe stocks, and (d) cucumber scions on cucumber stocks, the scion did not affect the reaction of the stock to the pathogen, nor was the relative susceptibility of the scions modified by that of the stock.

HEUBERGER (J. W.). **Virus disease on the California Wonder Pepper in Delaware in 1942.**—Abs. in *Phytopathology*, xxxiv, 11, pp. 991–992, 1944.

California Wonder [chilli] pepper plants were raised from two seed sources in special houses. In the field, where opportunities for natural infection were equal, those from one source averaged 54 per cent. mosaic compared with less than 1 per cent. for plants from the other locality. No mosaic having been observed in the plant houses, the remarkable disparity in the incidence of infection may denote differential susceptibility to the disease in the field. A new disorder, believed to be of the virus type, was also present, characterized by a continuous yellow discoloration originating at the petiole and extending towards the leaf apex. Infected foliage is readily shed. Fruits already formed at the time of infection later acquire a yellow discoloration, often combined with pitting, while those produced subsequent to the attack fail to mature. Plants from the same seed source developing a high percentage of mosaic were similarly susceptible to the new trouble, which is provisionally named 'yellow leaf'.

GÓMEZ-MORENO (M. L.). **Aráceas de Fernando Póo.** [Araceae of Fernando Po.]. *Ann. agric. Terr. esp. Golfo de Guinea*, 1942, pp. 7–37, 16 figs., [1943. Received February, 1945.]

The following observations of phytopathological interest occur in this study on the indigenous species of Araceae cultivated on the island of Fernando Po, Gulf of Guinea. The corms of *Colocasia antiquorum* Schott (*C. esculenta* Linn.), *Xanthosoma violaceum*, and *X. mafaffa* are subject to a dry rot similar to that referred to by Massee in [*J. Linn. soc. Lond.*, xxiv, p. 45] 1887 to *Peronospora trichotoma* but caused in this instance by *Pythium aphanidermatum*, while *Phytophthora colocasiae* [*R.A.M.*, xx, p. 514] occasionally attacks the foliage.

OSTERWALDER (A.). **Von einer noch wenig bekannter Bakterienkrankheit an Rebblättern.** [On an as yet little known bacterial disease of Vine leaves.]—*Schweiz. Z. Obst- u. Weinb.*, liii, 16, 282–284, 1 fig., 1944.

A bacterial disease of vine leaves originally described by A. Zschokke from the Palatinate in 1902 and observed sporadically in the vineyards surrounding the Lake of Zürich since 1933, is characterized by large, brown, withered lesions with an abundant sprinkling of small (1 mm. in diameter), angular spots, which on pressure exude myriads of bacteria. The parasitic function of the organisms is evident from their occurrence in the midst of the green tissues and chlorophyll-containing cells, mostly in the intercellular spaces. The bacteria tend to congregate

in the air chambers below the stomata, through which infection presumably takes place. The disease is confined to the older leaves and mostly affects Räuschling vines. The inoculum appears to proceed from the soil in the form of primary spring infections.

BREED (R. S.), MURRAY (E. G. D.), & HITCHENS (A. P.). **The outline classification used in the Bergey Manual of Determinative Bacteriology.**—*Bact. Rev.*, viii, 4, pp. 255–260, 1944.

The outlines of the revised classification to be used in the new (sixth) edition of Bergey's Manual of Determinative Bacteriology [*R.A.M.*, xix, p. 203], which it is hoped to issue in 1945, are set forth and briefly discussed in relation to some other methods of grouping developed since 1900.

RUDORF (W.). **Resistenzzüchtung, ihre Grundlagen und Methoden.** [Breeding for resistance, its principles and methods.] *Z.PflZücht.*, xxv, 3 4, pp. 190–208, 1943.

Nearly all the 75 papers cited in the bibliography appended to the author's survey and critical discussion of the principles underlying the breeding of plants for resistance to disease and the experimental methods applied to secure that object have been noticed from time to time in this *Review*.

MOORE (W. C.). **Cereal diseases in England and Wales.**—*Ann. appl. Biol.*, xxxi, 4, pp. 360–362, 1944 [1945].

The data obtained during the surveys organized by the Ministry of Agriculture and Fisheries since 1917 show that the chief cereal diseases in England and Wales are to be found among the rusts, foot rots, and stripe diseases, but that none of these cause such heavy economic losses in Britain as they do sometimes in one or other of the main cereal-growing areas of the world.

The most important rust is *Puccinia glumarum*. It is most prevalent on wheat, fairly common on barley, and occasionally present on rye. No alternate stage is known, and its survival depends on the overwintering of the uredospores, which can withstand many degrees of frost, though often killed by high summer temperatures. Temperature is not the only important factor affecting this disease, however; the winter of 1943–4 was mild, yet yellow rust was much less serious in 1944 than it was after the equally mild but wetter winter of 1942–3. Although it is the most injurious of the cereal rusts in Britain, only about once in ten years does it reduce yields by more than an estimated 5 to 10 per cent.

Black rust (*P. graminis*) never causes the devastating losses experienced in North America, and on the whole has very little economic significance. The uredospores are usually killed by winter temperatures, and in most years infection arises from affected barberries. The disease occurs every year on wheat in south-western Wales [*R.A.M.*, xxiii, p. 88], where barberry bushes are common. Very occasionally, as in 1940, it becomes epidemic in many parts during August, in which case yields are affected. These outbreaks seem to occur in years when large numbers of uredospores are blown over from the Continent. The brown rusts of wheat [*P. triticina*], barley [*P. anomala*], and rye [*P. dispersa*] are common and apparently harmless, but oat crown rust [*P. coronata*] leads to insufficiently filled ears and poor yields in Wales and south-western England in some years.

Of the smuts, wheat bunt (*Tilletia caries*) remains the most important, being responsible for the loss or spoilage of thousands of bushels annually. In 1921–2, one-third of the wheat samples examined at the Official Seed Testing Station, Cambridge, were visibly affected. By 1940–1, the figure had fallen to 1·2 per cent. During the last two years, however, incidence appears to have risen [*ibid.*, xxiv, p. 51]. It is thought that soil infection does not occur in England, but this point

needs investigation. There appears to be no record of *T. levis* [*T. foetida*] on growing crops in Britain.

Take-all (*Ophiobolus graminis*) of wheat and barley is troublesome only in wet seasons and on light soils overlying chalk or limestone, or where the rotation is too short. In 1942, a somewhat severe outbreak of *Gibberella zeae* occurred in mid-Wales [chiefly on oats, but also on wheat and barley: loc. cit.], indicating the possibilities of this hitherto rare disease. *Helminthosporium sativum* seems to be uncommon in this country.

Little is known of the effect on yield of barley leaf stripe (*H. gramineum*) and oat leaf spot (*H. avenae*). Both are prevalent everywhere, and both may be responsible for poor stands, especially in northern and western areas, but really serious losses appear to occur only in isolated instances.

Bad infection by mildew (*Erysiphe graminis*) generally follows a mild winter and a dry spring, and under these conditions, particularly if yellow rust is also severe, deaf ears and shrivelled grain may be expected. Ergot (*Claviceps purpurea*) [ibid., xxii, p. 94] is generally found in small quantities in descending order on rye, wheat, barley, and oats, but the disease is not important. It becomes prominent only when cool, wet weather prolongs flowering. In the past 25 years these conditions have been fulfilled only on a few occasions, notably in 1927 and 1928.

DILLON WESTON (W. A. R.). **Looking back and looking forward. (A retrospect of cereal diseases in East Anglia in the past 21 years.)**—*Ann. appl. Biol.*, xxxi, 4, pp. 366–370, 1944 [1945].

During the period from 1930 to 1940, land in East Anglia was planted too heavily to wheat, with the result that the soil became sick with *Ophiobolus graminis*. To-day, take-all is no longer a major problem, though it sometimes causes difficulty on the lighter-textured soils and in cereals which follow broken-up old grassland.

It is not at present known whether leaf blotch of barley (*Rhynchosporium secalis*) [*R.A.M.*, xxi, p. 154] affects yield or malting quality. The fungus is not seed-borne. Infection is usually more marked in a wet May, and it appears to carry over from year to year on volunteer barley, but the fungus also attacks various grasses, such as cocksfoot [*Dactylis glomerata*], wall barley [*Hordeum murinum*], couch [*Agropyron repens*], soft brome [*Bromus mollis*], and sterile brome [*B. sterilis*].

In seed-disinfection trials at Cambridge in 1942 harvesan completely controlled barley leaf stripe [*Helminthosporium gramineum*] and wheat bunt [*Tilletia caries*] and gave only 0.37 per cent. oat leaf spot (*H. avenae*). In 1943, harvesan gave 0.81 per cent. wheat bunt and ceresan 0.75 per cent., while the former and lunasan [ibid., xxii, p. 56] each completely controlled oat leaf spot.

If the scheme started in 1943 for the official approval of fungicides [ibid., xxiv, p. 25] is to maintain its prestige, the standard of efficiency demanded must be strictly preserved; it must be assessed by field tests; and the results must be made available to farmers. This would necessitate setting up an official testing station.

DENNIS (R. W. G.). **Cereal diseases in Scotland.**—*Ann. appl. Biol.*, xxxi, 4, 370–374, 1944 [1945].

After pointing out that in most of Scotland the most important oat disease is still the seedling-blight phase of leaf stripe (*Pyrenophora avenae*) [*R.A.M.*, xiv, p. 690], the author refers to the practice of seed treatment in Scotland, and states that in 1932, only 18 months after the first published mention of dry seed-dressing in *Scot. J. Agric.*, 266,795 lb. of ceresan were sold in Scotland, enough to treat 2,134,360 bush. seed-grain. Almost the whole of this was certainly used on oats. By the spring of 1933, five Scottish firms were advertising machines for applying dry disinfectants to oat seed.

Ceresan was first advertised in *Scot. Fmr* on 31st January, 1931, agrosan G on

14th January, 1933, and leytozan CC on 25th February, 1933. Harvesan appeared on the Scottish market at about the same time as it did in England. It is not possible to give exact figures for the total sales of these materials, but it would seem that their use continues at a satisfactory level.

While seed-dressing is general in the west and to some extent in the north of Scotland, little benefit is derived from the practice on the best Lothian soils and in other favoured parts of the east coast, even with heavily infected seed.

Some species of *Fusarium*, particularly *F. nivale* [*Calonectria graminicola*] are also partly responsible for low brairds of oats sown under poor soil conditions. When inoculated seed was sown in the ground out-of-doors on 24th February at a soil temperature of 3° C., *F. culmorum* had little effect, but *C. graminicola* reduced the braird from 66 to 40 per cent.

Gibberella zeae has also been somewhat prevalent in recent years on ripening oats and especially on straw damaged by take-all [*Ophiobolus graminis*] or by insects in the south-western parts and the islands. In inoculation tests, it had no effect on seedling growth or emergence.

In addition to the injury caused by seed-borne *Fusarium* spores, there is evidence that in the west of Scotland and probably in cold, wet soil elsewhere, considerable loss of oat seed is due to rotting by soil fungi. A field experiment indicated that this can be checked to some extent by organo-mercury seed dressings.

The oat smuts, *Ustilago avenae* and *U. kollerii*, are now present in only a few backward districts, especially in the north.

Stem rust (*Puccinia graminis*) is not uncommon on oats in the Tweed valley, where the barberry is a common hedge plant. Elsewhere, it is sporadic and of no importance. In most areas, oats are free from crown rust (*P. coronata*), but extensive outbreaks still occur at long intervals, the most recent one of any importance being in July, 1933. As *Rhamnus* bushes are not native to Scotland, and the uredospores do not appear to survive the winter, the outbreaks seem to originate from wind-blown uredospores from some area where *Rhamnus* is prevalent. The relative freedom from this disease appears to be due to the absence of the alternate host and the obstacles to the spread of inoculum imposed by natural barriers.

As regards wheat diseases, bunt [*Tilletia caries*] is scarcely ever seen, even when infected, untreated seed is sown. *P. tritici* is also unknown. *P. glumarum* can be found if hunted for, and in 1943 was alarmingly conspicuous. The outbreak caused less damage than was expected, but in many instances it led to a reduction of yield estimated at 8 bush. per acre.

WALTERS DAVIES (D.). **Cereal diseases in mid-Wales.**—*Ann. appl. Biol.*, xxxi, 4, pp. 374–376, 1944 [1945].

Of the cereal rusts found in mid-Wales, crown rust (*Puccinia coronata*) is the most important and destructive, appearing every year on oats, rye grass [*Lolium perenne* ? and *L. multiflorum*], and other grasses. Incidence is largely determined by climatic conditions, but with oats time of sowing and the practice of manuring affect severity of attack. Late-maturing crops generally sustain the heaviest infection, and crops well supplied with nitrogenous fertilizers suffer more than crops growing under more natural conditions. Epidemics occur at periodic intervals, and severe outbreaks arise once every nine or ten years, when the yield of susceptible varieties may be reduced to 5 cwt. per acre. All commercial varieties are affected, but the Scotch Potato oat and its related varieties, Castleton and Pure Line potato, are extremely susceptible.

Next in order of importance is yellow rust [*P. glumarum*] which, with mildew (*Erysiphe graminis*), causes considerable damage to wheat and barley. As regards smuts, all the common forms are present, *Tilletia caries* on wheat, *Ustilago avenae* on oats, and *U. hordei* on barley being the most important. *Ophiobolus graminis*

and its var. *avenae* are widely distributed, presumably owing to the high rainfall and the frequency with which cereals are now grown in a rotation. A survey of 30 farms where wheat had failed showed that take-all was more prevalent in crops grown after grass than in those grown after stubble. It was associated with all wheat failures, but there was evidence that other factors may be responsible for loss of crops. Only *O. graminis* var. *avenae* was found in 1943. Wheat and oats can tolerate infection and grow vigorously. Typical mycelial growth was often observed on the roots of matured plants in the absence of basal infection of the tillers. Lime encouraged take-all incidence.

Helminthosporium avenae does considerable damage to oats in the seedling stage, many crop failures being attributed to it. Ear blight caused by *Gibberella zeae* was frequent on wheat, oats, and barley in the exceptionally wet seasons of 1942 and 1943.

BROOKS (F. T.). **Biological specialization in the cereal rusts.**—*Ann. appl. Biol.*, xxxi, 4, pp. 362–366, 1944 [1945].

That eight physiologic races of *Puccinia triticina* should have been first discovered in England in spite of the apparent absence of the aecidial stage on *Thalictrum* may perhaps point to genic mutation in the uredospore stage being an important factor in the evolution of new races.

From 1931 to 1934 Mrs. Bawden examined many collections of *P. glumarum* on wheat from different parts of the country and showed that several races were involved [cf. preceding abstract]. The results of her work, however, were not published. In 1931 and again in 1932, single collections of yellow rust on wheat in England were determined (in Canada) as race 4. Yellow rust on wheat at Cambridge, sent to Germany in 1933, proved to be race 4, while another collection, sent in 1934, was race 6. In 1943, during an epidemic outbreak, Desprez 80 wheat was badly attacked in southern England, but only slightly affected in the north, indicating the presence of two races. Whether mature plant resistance occurs is uncertain, but Little Joss wheat, which is sometimes heavily infected in February, becomes markedly free from infection as maturity approaches.

At least 30 races of *P. anomala* [*R.A.M.*, xviii, p. 666] have been identified; of these, four were first discovered in Britain, where one is widely distributed [*ibid.*, xviii, p. 387].

Attention is drawn to some of the difficulties met with in determining the physiologic races of cereal rusts. Genetic purity of the differential varieties and of the rust cultures is essential. Seed stocks of some varieties received from abroad may be impure, and it may take one or more seasons to eliminate rogues. As, however, cereals are mostly self-pollinating, once a pure stock has been obtained the risk of out-pollination is small, especially if the ears are bagged before flowering. The only sure way to secure a pure rust culture is to establish it from a single uredospore, as more than one race may be present on a leaf collected in the field. Pure cultures must be kept in isolation from one another, e.g., in cellophane cylinders or cages, at a temperature tolerated by the rust. With *P. glumarum*, it may be necessary to store the spores at a low temperature before hot weather intervenes. Workers must be on their guard against contamination of pure cultures by extraneous races. Few glasshouses can be kept altogether free from insects, and there is always a risk that spores may be transferred when the stock cultures are exposed. Host varieties should be inoculated at the same stage of seedling development, usually on the first or second leaf, and should be covered with bell-jars for 48 hours. Each rust has an optimum temperature for development, e.g., 22° to 25° C. for *P. graminis* and 13° to 16° for *P. glumarum*, and at some centres the tests are conducted in temperature-controlled glasshouses. Where these are not available, the work should be done at periods when the range of temperature

approximates to that of the optimum for the particular rust being studied. Tests must be made when the light is good at Cambridge; it is useless to test physiologic races during winter, because of the long spells of dull weather. Further, it is advisable to test as many races as possible of one rust simultaneously, in order to eliminate environmental differences; this is particularly important where there is no rigid temperature control.

GARRETT (S. D.). **The take-all disease of cereals.**—*Ann. appl. Biol.*, xxxi, 4, p. 376, 1944 [1945].

Growth of the runner hyphae of *Ophiobolus graminis* [*R.A.M.*, xxiii, pp. 59, 130, 338; xxiv, p. 95] along the host roots is favoured by good soil aeration and an alkaline soil reaction. Further, light-textured soils also favour the disease because they are usually poor in nitrogen and often in other plant nutrients. Cereals in soil well supplied with nutrients can produce new secondary roots to replace those destroyed by the fungus, but deficiency of nitrogen, phosphorus, or potassium will curtail this power of recovery. The widespread outbreaks observed in the Southern Advisory Province in 1943 may have been partly due to leaching-out of nitrates by the heavy January rainfall. A coincidence of patches of take-all with low-lying areas flooded in winter may perhaps be due to such leaching-out of nitrate nitrogen.

Survival of the fungus in root and stubble residues mainly depends on an adequate nitrogen supply from the surrounding soil. In such conditions, *O. graminis* forms new branch hyphae, which can explore the non-eroded cell tissue, enabling the fungus to survive.

WATSON (I. A.) & WATERHOUSE (W. L.). **A third factor for resistance to *Puccinia graminis tritici*.**—*Nature, Lond.*, clv, 3929, p. 205, 1945.

A third factor for resistance to *Puccinia graminis tritici* race 34 has been found by the authors in the Kenya wheat varieties. In New South Wales, this race formed the bulk of the stem-rust inoculum used in breeding work until 1941, and Kenya 743, 744, and 745 were highly resistant to it. Genetical studies showed that the resistance of each variety was, apparently, governed by a single major factor. Work on F_3 lines showed that in 744 the factor is the same as that for resistance to races 17, 36, and 56, while the one in 745 is K_1 , these factors being inherited independently [*R.A.M.*, xxiii, p. 95]. These factors are not allelic with the one present in 743, because when this variety was crossed with 744 and 745 in turn and F_2 seedlings tested with the standard race 34, approximately 15 were resistant while one was susceptible. Although a new rust capable of attacking 743 has recently arisen in Australia, 744 and 745 remain resistant to it. In these last two varieties it would seem that the same gene gives resistance to both the new and the old rusts. Other varieties known to possess a single major gene for resistance to the standard race 34 were crossed in turn with each of these three varieties, and on a basis of the segregations of F_2 and F_3 seedlings their relationship to them was determined. So far, 744 is alone in one group, but the other two groups are well represented. All varieties which fall into the group with 743 are susceptible to the new rust which attacks this variety. Included in the 745 group are varieties with a single factor for resistance derived from Gaza wheat (*Triticum durum*).

DARLEY (E. F.) & HART (HELEN). **Effect of nutrient levels and temperature on the development of *Puccinia graminis tritici*.**—Abs. in *Phytopathology*, xxxiv, 12, p. 998, 1944.

Wheat seedlings grown at low nutrient levels responded to inoculation with *Puccinia graminis tritici* by the development of severe chlorosis, poor uredospore germination, and relatively mild types of infection, whereas at high nutrient levels there

was virtually no chlorosis and the other conditions were reversed. In adult plants, a high nutrient level delayed maturity by up to three weeks, but barely affected reaction to stem rust. Mycelial production and sporulation in seedlings were most profuse at 85°, and scantiest at 65°. Both seedlings and fully grown plants of one of the Kenya wheats were susceptible to several races of *P. g. tritici* at 85°, but resistant at 72° and 65°. Newthatch seedlings were flecked by race 17 at 85°, but seemed immune at the two lower temperatures.

MINZ (G.). **Control of rust in Wheat by sulphur dust (2nd trial).**—*Hassadeh*, xxv, 3–4, p. 107, 1945. [Hebrew.]

In the second trial of dusting wheat with supertine Gaza sulphur for the control of rusts [*R.A.M.*, xxiii, p. 336], particularly stem rust (*Puccinia graminis*), Florence (Morocco origin) was treated as soon as the disease appeared, five treatments being given from 2nd April to 3rd May, 1944. Heavy rust occurred that year. The dusted plants yielded an average of 284 and the undusted 201 kg. per 0.1 ha., respectively. The increase in yield due to the sulphur treatment was thus 41 per cent., and the loss from stem rust 29 per cent., respectively. The increase in weight of 1,000 seeds ranged from 34 to 42 gm. (23 per cent.). The amount of sulphur applied by a hand-duster was relatively large in order to ensure thorough control (70 kg. per $\frac{1}{10}$ ha. for the five treatments).

The following observations of interest may be added. The dusted plants matured ten days earlier than the undusted, the height of straw of the former being 150 as compared with 100 cm. for the latter. The kernels from untreated plants bore yellow spots up to an average of 24 per cent. as against only 0.2 per cent. from the dusted. An analysis of the flour revealed less protein and gluten and inferior gluten and baking quality.

FANG (C. T.). **Physiologic specialization of *Puccinia glumarum* Erikss. and Henn. in China.**—*Phytopathology*, xxxiv, 12, pp. 1020–1024, 1944.

Nine physiologic races of *Puccinia glumarum* [*R.A.M.*, iii, p. 266; x, p. 713; xiii, pp. 689, 757; xviii, p. 734] were identified in 43 collections, mostly from Yunnan Province, China, separation being based on differences in infection type on seven varieties of wheat, namely, Carsten V, Heine's Kolben, Vilmorin 23, Hybrid 128, 9H77 Carina, and Michigan Amber, and one of barley, Heil's Franken. The races, which are distinct from any hitherto known, are designated C1 to 9 consecutively. C1 is much the most virulent of the new races and second in prevalence to C3 in the Kunming district. Of 1,487 varieties tested for their reactions to these two races over a four-year period, 30 were either immune or highly resistant. All but two of the resistant varieties were of foreign origin.

SIBILIA (C.). **Sulla resistenza alle ruggini di alcuni Grani di montagna.** [On the resistance to rusts of some mountain Wheats.]—*Ital. agric.*, lxxix, 12, pp. 638–641, 1942. [Received 1945.]

In most years, infection of wheat by yellow rust (*Puccinia glumarum*) becomes general in central Italy between the middle and the end of April and in the north 10 to 15 days later; then comes brown rust (*P. triticea*); and finally, black rust (*P. graminis*) develops almost everywhere in these regions towards the end of May. In 1942, however, temperatures in April and most of May were low, and yellow rust was not found in central Italy until 20th May; spread was slow. In the few acres in which infection reached epidemic proportions, both yellow and black rusts were found together, a very unusual occurrence, but as the temperature rapidly rose, conditions became favourable to black rust, and in the hill regions, where maturation is delayed, losses reached up to 50 per cent.

The season was also unfavourable to brown rust. Attacks did not become intense

until the middle of June and even then they were less serious than usual, maturation having occurred some days earlier than in most years.

Observations over four years showed that 16 strains of Est (Mattin) wheat, viz., Vd 4, Cr. 1139, 18a, 18/2, 39a, 39/17, 72 35, 72/17, 72/23, 94/5, 94/11, 99/5, 99/9, 110/3, 108/9, and 108/2, and six of Andriolo, viz., 10/12, 12/5, 49/3, 34/6, 36/14, and 12/38, were almost immune from yellow rust. With regard to brown rust, as in previous years, a few strains were severely attacked, but on the whole damage was regarded as of limited importance where the strain was resistant to the other two rusts.

With regard to *P. graminis*, observations over a number of years showed that the following were highly resistant, viz., Est: Vd4, Cr. 1139, 72 35, 72 17, 72/23, 94/5, 94/11, 99/9, 39/17, 108 2, 18/2, and 18a; Andriolo, 12 5, 49 3, and 36 14.

The observations made also showed the importance of the anthocyanic pigmentation in relation to resistance, particularly resistance to *P. graminis*. This is known to be a very important factor in resistance to cold, and therefore is of special importance in mountain wheats. The effect of the anthocyanic reaction of the tissues is clearly seen in the development of the rust lesions. Very often, some of the strains, e.g., Est: 72/17, 72/73, 72 35, Cr. 1139, and Andriolo 10 12, showed numerous infection centres on the sheaths and the last internode, but these centres, surrounded by tissues in which anthocyanin immediately formed, remained punctiform, whereas in very susceptible varieties they developed into large, lacerated areas.

Anthocyanic pigmentation, however, though important, is not the only factor in the resistance to *P. graminis* shown by these strains. Some lack the reaction entirely, e.g., Andriolo 34/6, and yet are appreciably resistant. Some have it and are moderately susceptible, e.g., Est 39/a, 94 5, and 110 3. Further work will be carried out on this point.

Of great importance with regard to resistance is the site of the lesions [R.A.M., x, p. 368], particularly the behaviour of the last internode. The presence of lesions on the sheaths does not greatly affect yield, whereas heavy infection of the top internode does. Est 94/5, 94/11, 99 9, and Cr. 1139 showed scarcely any lesions on the last internode; those that were present were punctiform, did not enlarge, and were mostly surrounded by a halo of tissues containing abundant anthocyanin. Infections on the sheaths were more numerous.

It is concluded that most of the strains studied showed marked resistance to yellow rust, less to brown rust, and satisfactory resistance, at least on the part of 10 strains, to black rust. These 10 strains (all the Est strains listed above as highly resistant to *P. graminis* except 39/17 and 18a) having undergone testing in different localities for several years, must, presumably, have successfully overcome attack by the most virulent and widespread physiologic races of *P. graminis*.

WELLS (D. G.) & SWENSON (S. P.). **Inheritance and interaction of genes governing reaction to stem rust, leaf rust, and powdery mildew in a spring Wheat cross.**—Abs. in *J. Amer. Soc. Agron.*, xxxvi, 12, pp. 991–992, 1944.

The F_2 , F_3 , and F_4 progeny of a cross between a hard red spring wheat selection of H44-Reward $\times$ Baringa (HRB) and a soft white spring wheat selection of Hard Federation $\times$ Dicklow (HFD) were investigated at the Washington State College for their reactions to stem and leaf rusts [*Puccinia graminis* and *P. triticea*] and powdery mildew [*Erysiphe graminis*]. HRB was moderately resistant to *P. graminis* and equal to H44 in resistance to *P. triticea* and *E. graminis*, while HFD was susceptible to all three diseases.

Powdery mildew occurred spontaneously in the nursery, and epidemics of the rusts were induced by the introduction of two prevalent physiologic races of *P. graminis* and four of *P. triticea*. The response to the former rust was apparently

governed by two or three gene pairs, while single gene pairs, *Lm lm* and *Ms ms*, were evidently concerned in the reaction to the other two diseases. From analyses for associations between genes for reaction to the three diseases under investigation, a cross-over value of 20.8 ± 2 per cent. was established between the *P. triticina* and *E. graminis* genes. Significant linkages were found for the associations stem rust versus leaf rust and stem rust versus mildew, but these two connexions were not corroborated by subsequent data from a related cross.

REICHERT (I.). **On the disease resistance of wild Emmer.**—*Palest. J. Bot.*, R. Ser., iv, 2, pp. 179–183, 1 fig., 1944.

In two field experiments conducted in the central coastal plain of Palestine in 1924–5 and 1927–8, seeds of at least three varieties of wild emmer (*Triticum dicoccoides*), viz., *spontaneo-nigrum*, *kotschyganum*, and *fulvo-villosum*, dusted with dry bunt (*Tilletia tritici*) [*T. caries*] spores from Jiljilie wheat (*T. durum* var. *melanops*) gave rise to a high proportion of diseased plants (55 out of 77, 3 out of 6, 4 out of 5, and 6 out of 6 in four tests).

It was long assumed that the tetraploid (28-chromosome) wheat species, including *T. durum*, were resistant to bunt, but observations show that this axiom is not universally applicable. Wild emmer comprises, according to Jacobziner (*Bull. appl. Bot. Select., Suppl.* 53e, 275 pp., 1932), no less than 19 varieties, so that besides the above-mentioned three susceptible, there may well be a number of resistant ones. Another explanation of the discrepancy between the reactions of emmer to the disease in Palestine and elsewhere may lie in the existence in the former country of particularly virulent physiologic races of the pathogens capable of breaking down the normal resistance of the host.

PETERSON (R. F.) & MEREDITH (W. O. S.). **Agronomic quality characteristics of Carleton durum Wheat grown in the durum Wheat area of western Canada.**—*Sci. Agric.*, xxv, 2, pp. 107–111, 1944.

Mindum has long been the leading variety in durum wheat, but though outstanding agronomically it was a little deficient in straw strength and rust resistance. Carleton was obtained by crossing Mindum with Vernal Emmer and back crossing with Mindum. While the yield of Carleton is slightly less than that of Mindum, it is distinctly superior in strength of straw and resistance to stem rust [*Puccinia graminis*], though somewhat more susceptible to kernel smudge [*Alternaria* and *Helminthosporium* spp.: *R.A.M.*, xvii, p. 448]. Both varieties are highly resistant to leaf rust [*P. triticina*] and root rot [*Pythium* spp.] and moderately susceptible to bunt [*Tilletia caries* and *T. foetida*]. The macaroni quality appears to be equal if not superior to that of Mindum.

GLYNNE (MARY D.). **Eyespot, *Cercospora herpotrichoides* Fron, and lodging of Wheat.**—*Ann. appl. Biol.*, xxxi, 4, pp. 377–378, 1944 [1945].

Wheat eyespot (*Cercospora herpotrichoides*) [*R.A.M.*, xviii, p. 448] is found in England, Wales, and Scotland, increasing from west to east as the frequency of wheat- and barley-growing becomes more pronounced. To estimate the loss sustained through the disease, it is necessary to know the direct loss caused by eyespot itself, and the indirect loss caused by lodging, as well as the distribution and percentage of the disease in the wheat crops of the country and the percentage area lodged by eyespot each year.

Pot tests in which infected plants were compared with healthy ones showed that whereas almost all the latter survived, the loss through death was 23 per cent. at a low level of fertility and 11 per cent. when nitrogen was supplied. The loss in total yield of grain was 44 and 16 per cent., respectively.

In 1943, eyespot in a heavily infected field was reduced by 10 per cent. by

autumn spraying with sulphuric acid. With the decrease in eyespot there was an increase in yield of 18 per cent., equivalent to about 3 cwt. grain per acre. This result may have been partly due to reduction of weeds by the treatment. In small-scale field tests by Wendy Dion in which weeds were removed, spraying with sulphuric acid in spring gave an increase of 33 per cent. total grain associated with a decrease of 31 per cent. straws severely infected by eyespot.

In another experiment, some 20,000 straws were obtained at harvest; the healthy ones and those with superficial lesions yielded twice as much grain per straw as did the severely affected ones. On this basis, the loss in yield would be 0.5 per cent. grain for every 1 per cent. straws severely infected at harvest, so that a field with 60 per cent. badly diseased straws would lose about 30 per cent. of its grain. The general evidence indicates that this is a reasonable estimate. Further loss is entailed by the fact that the grain produced by diseased plants is of small size, so that there is more tail corn from affected than from healthy plants.

Loss due to lodging, independently of eyespot, was determined by inducing it at different dates before harvest. The earliest lodging gave the greatest loss, the figures being 54 per cent. of the grain in plots lodged $6\frac{1}{2}$ weeks before harvest and 29 per cent. four weeks later. In a later trial, birds increased the loss from lodging to 74 per cent. Uninfected crops which lodge tend to fall in one direction and can be harvested by working one way with the binder, but when crops lodge as a result of eyespot, they fall in all directions, and must be harvested by scythe.

Wheat yields in England could be greatly increased by a more generous use of fertilizers, but farmers are afraid of lodging. This danger can be obviated by using short- or stiff-strawed varieties. The chief advantage of these, however, is lost unless they are manured up to a level of soil fertility at which long-strawed wheats are likely to lodge. The best means of controlling eyespot is by good rotations: ley-farming, in which arable and grass alternate every few years, would seem excellent for the control of both eyespot and take-all [*Ophiobolus graminis*]. Sulphuric acid spraying of eyespot-infected crops cannot yet be recommended for general use.

Two less serious diseases resembling eyespot are sharp eyespot due to *Corticium solani* [ibid., xxii, p. 426], which is common, but seldom severe, and white straw disease, caused by *Gibellina cerealis* [ibid., xvi, p. 801], so far found in this country only in one field, at Rothamsted.

PISAREV (V. E.) & MALINOVSKAYA (Mme E. S.). **The breeding of spring Wheats resistant to Fusarium.**—*Тр. Инст. Зерн. Хоз. нечернозём. Полос.* [Trans. Inst. Grain Fmg non-black-soil Distr.], 1941, 10, pp. 35-58, 1941. [Russian. Abs. in *Plant Breed. Abstr.*, xv, 1, pp. 39-40, 1945.]

The infestation of the soil round Moscow by *Fusarium avenaceum*, *F. culmorum*, and *F. spp.* of the *Elegans* section, the first-named being the most virulent, constitutes a serious obstacle to spring wheat cultivation. The fungi may either be present in the seed at sowing time or attack the young shoots on emergence. Prelude and certain varieties from eastern Siberia were found to be resistant to the former type of infection and Hybrid 170 (the offspring of a resistant local Norwegian wheat and the American Blue Stem) and Diamond to the latter, while Milturum 321 was highly resistant to the second and moderately so to the first. In the resistant varieties infection uniformly occurred at the base of the plants, but never extended beyond the coleoptile and did not involve the roots. In the case of susceptible varieties, the plants were either killed or made poor growth without tillers, depending almost exclusively on their primary roots and often devoid of grain in the ear. Early sowing at low temperatures, the use of large seeds, and careful attention to cultural methods are important factors in the reduction of *Fusarium* infection.

[An expanded summary of this paper, filed at the Imperial Bureau of Plant Breeding, Cambridge, presents in tabular form some further information on the effect of the pathogens on germination, the relation of virulence in *F. avenaceum* to soil temperatures, the comparative germinative capacities of resistant and susceptible varieties, and other aspects of the problem.]

HONECKER (L.). **Resistenzzüchtung gegen Mehltau und Rost bei Gerste. Erfahrungen und Ergebnisse vierjähriger Züchtungsarbeit.** [Breeding Barley for resistance to mildew and rust. Observations and results of four years' breeding work.]—*Z. PflZücht.*, xxv, 3-4, pp. 209-234, 1943.

Much of the available information on the work proceeding at the Weihenstephan (Bavaria) Plant Breeding Station in connexion with the breeding of barley for combined resistance to yellow and dwarf rusts (*Puccinia glumarum* and *P. simplex* [*P. anomala*]) and mildew (*Erysiphe graminis* var. *hordei*) [*R.A.M.*, xx, p. 251; xxiii, p. 11] has already been noticed from other sources. In general, the rusts caused little damage on mildew-susceptible varieties, being largely suppressed by their less exacting antagonist. This is particularly true of dry regions, where conditions are in any case unfavourable to rust development and highly conducive to that of mildew. Heavy epidemics of rust may be induced, however, by the elimination of *E. g. hordei* through the widespread cultivation of resistant varieties, thereby removing a natural check on the former pathogens.

The simultaneous occurrence on field plants of mildew, yellow rust, and dwarf rust may, in certain cases, confer a 'pathogenic equilibrium', so that the aggregate injury is relatively slight, even though individuals of the same variety may be severely attacked as seedlings in the greenhouse. Under comparable outdoor conditions, however, the yield reductions in partially resistant varieties may be much heavier in consequence of the unimpeded development of a single parasite. Thus, selections that are not fully resistant to all the members of a disease complex are liable to much larger yield fluctuations than varieties characterized by marked juvenile susceptibility but possessed of stable field resistance.

'Synthetic' breeding for resistance to the three diseases under investigation should therefore form the basis of further experimental work. The separate treatment of the various problems involved would merely delay the achievement of the primary objects of increased production and improved quality.

MINZ (G.). **On the occurrence of *Ustilago nigra* on Barley in Palestine.**—*Palest. J. Bot.*, R. Ser., iv, 2, pp. 205-206, 1944.

The author observed that loose smut of barley is more prevalent on Arab farms than on Jewish ones where the seed is always treated with seed-dressings. Nevertheless, *Ustilago nuda*, to which the loose smut was supposed to be due, is not amenable to control by this method, whereas *U. nigra* is. Of 31 samples of infected barley ears from various districts in Palestine, 20 yielded spores germinating slowly with branched mycelia corresponding to *U. nuda* and 11 spores germinating abundantly and rapidly produced sporidia like *U. nigra*. The different species were not confined to special varieties of barley or to special districts. In the presence of *U. nigra* the application of seed-dressings to barley seeds assumed increased importance.

REICHERT (I.), MINZ (G.), & PALTÍ (J.). **Trials for the control of covered smut of Barley by seed dressings.**—*Palest. J. Bot.*, R. Ser., iv, 2, pp. 171-174, 1944.

In six experiments between 1940 and 1943 designed primarily to compare the efficacy against barley covered smut (*Ustilago hordei*) of agrosan G (2 and 2.5 gm. per kg. seed-grain) and yellow sulphur dust (4 and 8 gm.), the former gave uniformly satisfactory results, reducing infection from 100 to a maximum of 1.9 per

cent., while the latter was effective only in milder cases. On the basis of these trials, therefore, G. Howard Jones's general recommendations for the treatment of *U. hordei* with sulphur [*R.A.M.*, xiv, p. 159] cannot be endorsed. Under Palestinian conditions it should be used only where the seed is reasonably free from contamination. A local mercurial product, caspan, which was applied in some of the tests as a sprinkle (75 gm. in 1.5 l. water per 50 kg. seed), proved inferior to the dusts in the control of covered smut.

COCHRAN (G. W.), JOHNSTON (C. O.), HEYNE (E. G.), & HANSING (E. D.). **Inheritance of reaction to smut, stem rust and crown rust in four Oat crosses.**—*J. agric. Res.*, lxx, 2, pp. 43–61, 4 figs., 1944.

The inheritance of resistance of oats to a mixture of races of *Ustilago avenae* and *U. levis* [*U. kolleri*], *Puccinia graminis* physiologic races 2 and 8, and *P. coronata* physiologic race 1 was studied in the crosses Richland-Fultex × Fulghum-Victoria and its reciprocal, Fultex × Richland-Fulghum, and Anthony-Bond × Richland-Fulghum in the field and in the greenhouse. The reaction of the first three crosses was similar, but the fourth differed in accordance with the genetic contribution of the Anthony-Bond parent.

Transgressive segregation for smut susceptibility was observed in the first three crosses. The parents showed high resistance to infection and the reaction of the F_2 and F_3 indicated that each parent carried a dominant factor for resistance: when both these factors were absent in the hybrid the plant was susceptible. A similar condition obtained in the Anthony-Bond × Richland-Fulghum cross, except that there was one dominant factor for high resistance to smut and one for moderate resistance.

Resistance to *P. graminis* was dominant in all four crosses and was apparently determined by a single factor.

The reaction to *P. coronata* of the crosses involving Fulghum-Victoria and Fultex was governed by a single factor dominant for resistance. The reaction of Anthony-Bond × Richland-Fulghum was more complex and was controlled by the interaction of four factor pairs, two sets of dominant complementary factors, one set, dominant complementary genes, carried by Anthony-Bond, the resistant parent, and the other set, dominant complementary inhibitor genes epistatic to the genes for resistance, carried by the susceptible Richland-Fulghum parent. The expected F_2 ratio was 35 fully resistant: 48 moderately resistant: 52 intermediate: 121 fully susceptible, and the expected F_3 was 7 lines breeding true for resistance, 128 segregating, and 121 true for susceptibility. The observed ratio in both F_2 and F_3 was statistically near to these. A further complication was that, in the seedling stage only, in the greenhouse, different effects were observed in phenotypes of different heterozygous conditions.

No association was observed between the factors determining the reaction to the different diseases.

WELSH (J. N.). **History, description, distribution and performance of Ajax and Exeter Oats.**—*Sci. Agric.*, xxv, 2, pp. 96–106, 2 figs., 1944.

Ajax, the product of a cross made in 1930 between Victory and Hajira, is resistant to the common races of stem rust [*Puccinia graminis*] found in Canada, moderately resistant to crown rust [*P. coronata*] in the mature-plant stage, and has a fairly high degree of resistance to smut [*Ustilago avenae* and *U. kolleri*] and halo blight [*Pseudomonas coronafaciens*]. It is an early maturing variety, and is rapidly becoming of major importance in Western Canada. Exeter, derived from Victory and Rusota (both resistant), is resistant to the common races of stem rust and considerably so to halo blight but susceptible to other diseases. Some 3,500 bush. seed was distributed to farmers in the winter of 1943–4.

HANSING (E. D.) & MELCHERS (L. E.). **Standard and new fungicides for the control of covered smut of Sorghum and their effect on stand.**—*Phytopathology*, xxxiv, 12, pp. 1034–1036, 1944.

The stand of pink kafir sorghum artificially inoculated with covered smut [*Sphacelotheca sorghi*] at the rate of 1 gm. spores per 200 gm. seed-grain was increased in a trial at the Kansas Agricultural Experiment Station in 1943 by seed treatment with spergon, arasan (2 and 3 oz. per bush., respectively), new improved ceresan, DuBay 1452-C (7.7 per cent. ethylmercury-*para*-toluene sulphonanilide), both at $\frac{1}{2}$ oz., and coronia coppercarb (3 oz.). These preparations increased the emergence percentage from 34 to 71, 67, 62, 61, and 57, respectively, while simultaneously reducing the incidence of smut from 56.8 to 0.4, 0.4, 0.0, 0.0, and 4.2 per cent., respectively. Micronized free-flowing and wettable sulphur (each at 3 oz. per bush.) did not augment the stand, but effectively combatted the disease (0.9 and 1.3 per cent. infections, respectively).

These results are important as showing that several economical and efficient seed-grain disinfectants are available without drawing on the copper and mercury resources of the country, which must be conserved for military purposes.

WANG (C. S.). **Physiologic specialization and the control of Millet smut.**—*Phytopathology*, xxxiv, 12, pp. 1050–1055, 1944.

Millet (*Setaria italica*) smut (*Ustilago crameri*) is responsible for heavy losses, ranging from 10 to 50 per cent., in north and north-eastern China [*R.A.M.*, v, p. 656]. Although the disease is controllable by seed treatment, it is preferable and more economical to combat it by the use of resistant varieties, and to this end the question of physiologic specialization within the species was investigated, nine chlamydospore collections [*ibid.*, xxiii, p. 174] from different parts of China being tested on 11 millet varieties at the Minnesota Agricultural Experiment Station in 1935 and on 12 in 1936. On this basis six physiologic races have been distinguished. Four collections were classified as race 1 because of their similarity in virulence on the five differential hosts, German No. 10, Kaifeng No. 232, Nanking No. 31, Unnamed Selection No. 12, and Siberian No. 13020, while each of the other collections represented a different physiologic race. All the varieties tested were susceptible to certain races of *U. crameri*: German No. 10 was the most resistant and Hungarian No. 232, Siberian No. 1120, and German No. 18 among the most susceptible. The relative prevalence of the different races must be taken into consideration in breeding *S. italica* for smut resistance.

Pending the development of resistant varieties, a temporary palliative must be sought in seed disinfection. Of the 11 preparations tested for this purpose, new improved ceresan ($\frac{1}{2}$ oz. per bush.) was the most effective, reducing the incidence of infection from 26.9 and 42.9 to 0.8 and 0.4 per cent. in 1935 and 1936, respectively. Fairly good results were also achieved with a formaldehyde dip (1 in 250), 2 oz. cuprocide, 4 oz. 20 per cent. copper carbonate, and 2 oz. barbak III, the amounts of smut in these plots being 1 and 1.1, 3.6 and 1, 3.1 and 3.1, and (in 1936 only) 4.6, respectively. In general, sulphur fungicides proved ineffective.

FAWCETT (H. S.). **A starch test for quick decline.**—*Calif. Citrogr.*, xxx, 4, p. 122, 1 fig., 1945.

In October, 1944, it was ascertained that Valencia and navel orange trees on sour orange rootstocks in the San Gabriel Valley, California, when recently visibly affected by 'quick decline' [characterized by sudden foliage wilting and eventual breakdown or death: *Calif. Citrogr.*, xxix, p. 245, 1944] showed no starch in the wood or bark of line roots at their outer extremities, and, in most cases, in the wood of larger line roots well in towards the trunk. Further tests showed that some orange trees on sour orange roots had outer line roots devoid of starch, generally

with some dead fibre roots, even before any sign of the disease could be detected in the tops. Later work showed this lack of starch almost invariably in recently affected trees, but not always in those which had shown decline for some months or a year or two, and in which deterioration appeared to have reached a kind of equilibrium.

A simple test for the presence of the condition was devised, in which potassium iodide solution (1.5 gm. potassium iodide, 0.3 gm. iodine, and 100 c.c. water) or standard-strength tincture of iodine added to water at the rate of 5 parts per 100, is dropped on to the cut surface of roots not more than $\frac{1}{4}$ in. in diameter dug up from the outer margin of the suspected tree, and in which a fresh cut has been made with pruning shears. If the tree is in an early stage of quick decline no dark blue or black colour will appear, or if it does, it will be central, or distinctly on one side of the wood. The test is not reliable if the deterioration has become arrested or the tree is putting out new growth.

HARVEY (J. V.). **Fungi associated with decline of Avocado and Citrus in California (II).**—*Plant Dis. Repr.*, xxviii, 34, pp. 1028–1031, 1944. [Mimeographed.]

Continuing his investigations on decline of avocado and citrus trees in California [*R.A.M.*, xxiii, p. 482], the author states that of 307 declining avocado trees examined, 164 yielded *Phytophthora cinnamomi*, while of 268 non-declining avocado trees, 46 yielded the fungus, mostly from trees in distressed groves. *Pythium vexans* was consistently present in diseased avocado roots.

In southern Californian soils, *Pythium ultimum* was found 49 times in 94 samples (52.1 per cent.), *P. debaryanum* 13 times (13.8 per cent.), and *P. avandrum* 6 times (6.4 per cent.). In 124 declining citrus trees, *P. ultimum* was found 57 times, and in 93 non-declining citrus trees 13 times. *Phytophthora citrophthora* was found 8 times in 124 declining citrus trees, and not at all in 93 non-declining citrus trees.

The evidence showed that excess water and poor drainage in most cases tended to initiate decline. In avocado, especially, decline appears to spread from focal points, the typical focal point being usually a swale or a point where water has been allowed to saturate the soil and remain over a long period.

NADEL (MINA). **Anatomical study of the button of Shamouti Oranges in relation to stem-end rot.**—*Palest. J. Bot.*, R. Ser., iv, 2, pp. 166–170, 1 fig., 1944.

The stem-end rot of Shamouti oranges, so prevalent in Palestine, is chiefly caused by *Diplodia natalensis* [*R.A.M.*, xx, p. 13] and to a minor degree by *Alternaria* sp. and *Colletotrichum gloeosporioides*. The rot is not apparent when the fruit is picked and begins to develop at the button end. Buttons were fixed with alcohol-formalin-acetic solution, sectioned and stained with cotton blue or Pianese solution. Mycelium was found superficially on the button, chiefly in the axils of the sepals and sometimes on the exterior of the lesions, but never internally. It was invariably separated from the fruit tissue by a layer of cork, but no hyphae were detected in the cork layer itself. After the petals and stamens had fallen, a cork layer formed some distance below and the tissue above became necrotic. It usually contained mycelium and on occasion spores, even when the fruit was only about 3 cm. in length. Hyphae have never been detected below the cork layer on fruit still attached to the tree.

In September, young fruits attached to the tree were wounded with a sterile needle, and some were also inoculated with a suspension of *D. natalensis* spores, brushed on to the surfaces of the fruits. Protective cork layers were formed around uninoculated pin pricks and between the mycelium and the fruit. Mycelium was never found inside the fruit in cases where the mycelium present in the buttons was shown by culture to belong to *D. natalensis*, *Alternaria*, or *C. gloeosporioides*. After picking, the mycelium of fungi present in the outer tissues of the button appears to penetrate the fruits in a manner not adequately understood and to cause storage rots.

MINZ (G.) & BEN-MEIR (YOHEBED). **Pathogenicity of *Diplodia* from various hosts to Citrus fruits.**—*Palest. J. Bot.*, R. Ser., iv, 2, pp. 162–165, 1944.

Stem-rot of Shamouti orange fruits may be induced by inoculation with spores of *Diplodia natalensis* [see preceding abstract], not only from twigs of all the other citrus species tested, namely, lemon, grapefruit, Valencia and bitter oranges, and mandarin, but also from the following hosts of the fungus in Palestine: *Acacia farnesiana*, groundnut, *Cereus straussii*, quince, loquat, *Euphorbia grandidens*, *Ficus elastica*, *F. nitida*, walnut, apples, mango, white and red mulberry, plum, *Ricinus communis*, rose, and vine. The isolates from Shamouti orange also infected lemon, grapefruit, and mandarin, while those from lemon and grapefruit were reciprocally pathogenic. The only sources of inoculum giving negative results in the cross-inoculation tests were date palm, *Mentha piperita*, and *Pyrus syriaca*. Hence there is a risk that *D. natalensis* from almost any of its hosts may attack the most important citrus fruits cultivated in the country.

WADE (G. C.). **Production of copper deficiency symptoms of Citrus in solution culture.**—*J. Aust. Inst. agric. Sci.*, x, 4, pp. 176–177, 1944.

In an experiment carried out in Victoria to ascertain whether citrus seedlings would develop copper deficiency symptoms when grown in solution culture, Valencia orange seedlings were grown in Arnon's solution (*Amer. J. Bot.*, xxvi, pp. 144–149, 1938), the main constituents of which were purified by Stout and Arnon's modification of Steinberg's method (*ibid.*, xxviii, pp. 322–328, 1938). All the heavy metals, save iron, known to be important for plant growth, were added to one series, and the same heavy metals, except copper and iron, to the other. Iron was added to all culture solutions at weekly intervals, as 0.5 per cent. ferrous sulphate plus 0.4 per cent. tartaric acid solution, 0.6 ml. being used per l.

The plants were grown in pyrex beakers blackened on the outside, with plaster of Paris tops coated with paraffin, and were aerated continuously with air filtered through caustic soda solution, dilute hydrochloric acid, double distilled water, and cotton wool. The solutions were changed every six to eight weeks.

The results showed that the copper-deficient plants grew much less rapidly than those in the complete solution, and had shorter internodes. After eight weeks, their terminal shoot developed into a multiple bud of the exanthema type, consisting of a cluster of 10 to 20 buds. After this, they made little further growth. Concurrently with the development of multiple buds, the youngest leaves showed an irregular, pale green mottling. The root growth was greatly reduced.

BLISS (D. E.). **The response of Khadrawy Date Palms in *Omphalia*-infested soil.** — *Rep. Date Grs Inst.*, 1944, pp. 13–16, 2 graphs, [? 1944].

Omphalia pigmentata and *O. tralucida* attack the Deglet Noor date variety so severely in California that it has sometimes been necessary to abandon the area to other crops. Observations indicated that other desirable species are less susceptible, and in May, 1933, an experiment was initiated on the resistance of Khadrawy in *Omphalia*-infested soil. Equal numbers of similar nursery-rooted offshoots of Deglet Noor and Khadrawy, of healthy appearance, were interplanted between rows of diseased Deglet Noor palms in a garden near Thermal designated T, and a similar lot of each of the offshoots was planted in the same garden but half a mile from the nearest known area of infection. Equal numbers of each species were also planted in another garden, near Indio, California, an area in which the disease had never been known. Samples of roots were taken from various palms at different times to test for and observe the progress of the disease. The results show that the infested area affects Khadrawy far less than it does Deglet Noor. For example,

in non-infested soil, the average growth of Deglet Noor palms was twice as great as that of Khadrawy palms, but in the infested soil the Khadrawy was twice that of Deglet Noor. The Deglet Noor variety showed the secondary symptoms of *Omphalia* root rot, such as small, weak leaves and fruit bunches, a yellowish colour, and a decline in vigour. The stunted Khadrawy palms were fairly green but lacked vigour.

In 1943 the Khadrawy palms bore 8 to 8.8 fruit bunches on non-infested soil and 6.3 fruit bunches in the infested soil. Deglet Noor bore an average of 10.9 to 12.1 in the control areas but only two in the root rot area. In 1940 a few Khadrawy palms in non-infested soil in both gardens were found to be infested with *Omphalia*. Assuming, as is probable, that the offshoots had been infected when first planted, this implies that the Khadrawy variety is a potential carrier of the disease in a masked form and a long-standing source of danger to other species. Further knowledge of disease resistance among commercial date varieties is of importance in the control of *Omphalia* root rot.

FRAZER (HELEN L.). **Observations on the method of transmission of internal boll disease of Cotton by the Cotton stainer-bug.**—*Ann. appl. Biol.*, xxxi, 4, pp. 271-290, 1 pl., 5 figs., 2 graphs, 1944 [1945].

A study of the transmission by *Dysdercus* spp. of internal boll disease of cotton caused by *Nematospora gossypii* and allied fungi [*R.A.M.*, xxi, p. 415; xxiii, p. 431] demonstrated a close association of the insect with diseased plants in nature, visitation of healthy plants by the insect under conditions suitable for transmission of the disease, the presence of the pathogen in or on the insect in nature, or following visitation of a diseased plant, and experimental production of the disease by insect visitation under controlled conditions. It is therefore claimed that *Dysdercus* spp. are proved vectors of the disease.

Spores and mycelium of the fungus were found present as an external contaminant on the mouth parts and internally in the deep stylet pouches, where spore germination is possible. The fungus is cast off with the exuviae during moulting, but recontamination occurs.

That spores sucked up with food should reach the alimentary canal via the normal food channels is readily understandable, but as regards their presence in the stylet pouches, three explanations are possible. These may be leakage during feeding, a view supported by direct observation of the insect anatomy. The spores might also enter via openings between the chitinous plates of the head: this, however, was disproved experimentally. Thirdly, the spores might pass through the living tissue from the intestine and re-emerge; but no evidence could be obtained to support this view. Observations indicated that the spores do not remain viable in the intestine. The insects become infective immediately after feeding.

As for the manner in which the fungus leaves the insect, the author's view is that it enters and leaves by the same route. The evidence did not show that the salivary glands become contaminated, and, further, to reach them the fungus would have to invade living tissues, there would be a time lag before the insect could cause infection, and infections would then occur with some regularity. This was not the case. Regurgitation appears to be improbable in view of the valve at the entrance to the midgut and the absence of any evidence that spores remain viable in the intestine. The observation by various workers that the disease develops only when the fungus is introduced through the wall of the cotton boll indicates that the inoculum must be conveyed via the proboscis, and rules out the possibility of passive infection from excreta. Attempts to observe the form in which the fungus leaves the insect were not successful. The observations showed that infections occur entirely at random, and support the view that ejection of the

fungus is by chance. Transmission is purely mechanical, with the insect obligatory solely in its function as a syringe to inject the fungus, which otherwise is unable to reach its substrate. Insect and fungus can develop independently and the insect appears to remain unharmed by the presence of the organism. No alternative morphological form of *N. gossypii* was found within the insect.

The results obtained do not affect the control methods already practised, i.e., insect-trapping, destruction of alternative hosts, and selection of planting time to avoid insect attack.

FULLER (W. H.) & NORMAN (A. G.). **The nature of the flora on field-retting Hemp.**—Abs. in *J. Amer. Soc. Agron.*, xxxvi, 12, pp. 1014–1015, 1944.

The field-retting of hemp involves the freeing of the fibre bundles from the surrounding softer tissue by the enzymatic action of micro-organisms. The microscopic examination at the Iowa Agricultural Experiment Station of strips of bark revealed a profusion of fungal mycelium growing over and through the surface, species of *Alternaria*, *Hormodendrum*, *Fusarium*, *Cephalosporium*, and *Phoma* being the most prevalent on all samples. *Fusarium* developed most frequently on green hemp just beginning to ret and on that in the bottom of the swath, being generally replaced by *Phoma* in the later stages of the process.

MUSKETT (A. E.) & COLHOUN (J.). **The prevention of seed-borne diseases of Flax by seed disinfection. II. Comparison of the dusting, short wet and fixation methods of treatment.**—*Ann. appl. Biol.*, xxxi, 4, pp. 295–300, 1944 [1945].

Continuing their investigations [*R.A.M.*, xxii, p. 358], the authors in 1942 sowed Liral brown flax seed showing 18.8 per cent. infection by *Polyspora lini* and 6.4 per cent. by *Colletotrichum lini* [*C. linicola*] after treatment with organo-mercury preparations. The rates of application per 500 gm. seed were: nomersan 3.35 gm., cerasan (1875 A) 3.35 gm. fixed with water 30 or 40 ml., cerasan experimental 3.35 gm. fixed with water 30 or 40 ml., cerasan (U. 564) 6 per cent., 40 ml., cerasan (U. 564) 8 per cent., 30 ml., cerasan (U. 564) 8 per cent., 40 ml., cerasan (U.564/2 B1) 6 per cent., 40 ml., cerasan (U. 564 2 B1) 8 per cent., 30 ml., and cerasan (U. 546 2 B1) 8 per cent., 40 ml. The crop yields in lb. per plot of 24 sq. yd., the seed being sown at the rate of 80 lb. per acre, were, respectively, 17.69, 22.41, 26.13, 25.72, 26.63, 27.78, 26.31, 27.88, 29.41, 25.25, 27.03, and 26.07, and the fibre yields 0.9, 1.61, 1.71, 1.76, 1.92, 2.1, 2.03, 2.34, 1.99, 2.22, and 1.87.

These and other results [which are tabulated] confirm the previous findings that the disinfection of flax seed materially helps to cleanse it from contamination with *P. lini* and *C. linicola*. Against *P. lini*, nomersan is only partially effective. Short wet or fixation treatment with organo-mercurial preparations gave much better control of *P. lini*, though they did not entirely eliminate it. All the treatments gave substantial control of *C. linicola*, cerasan U. 564/2/B1 being as effective as nomersan, which was highly satisfactory. In the case of stem-break and browning (*P. lini*), all the treatments significantly increased crop and fibre yields. As in 1940 and 1941, treatment of seed heavily infected with *C. linicola* did not significantly affect crop yield. Against *C. linicola* most of the treatments employed do not affect fibre yield to a greater extent than nomersan at 12 oz. per cwt. With seed only very slightly infected with either fungus, fibre yield was significantly increased by nomersan 12 oz. and cerasan U. 564, 8 per cent. at 0.9 or 0.67 gal. per cwt. The last-named treatment did not significantly affect crop yield. This result indicates that benefit may result from disinfecting seed not heavily infected with either parasite, and that such disinfection may carry with it a benefit other than that attributable to control of parasites. It would appear that no treatment consistently influences crop establishment under field conditions.

DIMOCK (A. W.) & ALLYN (H.). **Dipping rooted *Chrysanthemum* cuttings in fermate for *Septoria* leafspot control.**—*Bull. Chrysanth. Soc. Amer.*, xii, 2, pp. 8–11, 1944. [Mimeographed.]

In further trials in the New York district for the control of chrysanthemum leaf spot (*Septoria*) [*lobosa* and *S. chrysanthemella*: *R.A.M.*, xxii, p. 312] on the highly susceptible Yellow Fellow variety, dipping in fermate (1½ lb. per 100 gals.) plus DuPont spreader-sticker (3 fl. oz. per 100 gals.) gave such excellent results as to justify the use of this treatment for all the cuttings intended for field planting in 1943, when almost complete control was obtained under conditions highly conducive to infection. Late in the season the disease appeared in unprotected growth in cut-over beds, suggesting the survival of the pathogens either independently in the soil or on infected refuse from the previous season.

JENKINS (ANNA E.). **'Oedema' or wart of cultivated Violet identified as scab.**—*J. Wash. Acad. Sci.*, xxxiv, 11, pp. 352–357, 1 fig., 1944.

This is an expanded account of the writer's studies on the 'oedema' or 'wart' of cultivated violets in the United States, leading to its identification with the disease now known as scab (*Sphaceloma violae*), a preliminary note on which has already appeared [*R.A.M.*, xxiv, p. 150].

STAPEL (C.) & BOVIEN (P.). **Markførfgrødernes sygdomme og skadedyr.** [The diseases and pests of pasture crops.]—232 pp., 47 col. pl., Copenhagen, Det Kgl. Danske Landhusholdningsselskab [The Royal Danish Agricultural Society], 1943. [Received March, 1945.]

In this book, a companion to a similar treatise on potato diseases published in 1940 and to one by E. Gram and P. Bovien dealing with the diseases and pests of root crops (1942) [*R.A.M.*, xxii, p. 284], the authors present much useful information, supplemented by attractive coloured plates, concerning the parasitic and non-parasitic disorders of legumes (including clovers, lucerne, peas, field beans, and lupins), grasses, carrots and other Umbelliferae, sugar and fodder beets, and crucifers in Denmark.

JONES (F. R.). **Winter injury and persistence in Alfalfa.**—Abs. in *J. Amer. Soc. Agron.*, xxxvi, 12, p. 1,000, 1944.

In 1940, over 500 clones from unselected plants of four lucerne varieties [*R.A.M.*, xxii, pp. 420, 435] more or less resistant to wilt [*Corynebacterium insidiosum*] were set in cultivated rows at the Wisconsin Agricultural Experimental Station to determine their longevity under favourable conditions in the local environment. The four succeeding winters were not exceptionally severe, but after the fourth 12 to 20 per cent. of the clones were dead, and about twice as many in a poor state of health, presumably as a result of progressive deterioration following winter injury. The characteristic individual responses of these and other clones to winter injury have been found to become more apparent as the plants mature, those observed during the particular five-year period under discussion, for instance, showing great differences in their capacity to survive and flourish, with marked superiority in a small percentage. It would seem, therefore, that selections based on the actual performance of clones in a given region should give rise to a strain with enhanced resistance to the ordinary hazards of the local climate.

CHORIN (MATILDA). **Leaf and stem spot of Egyptian Clover.**—*Palest. J. Bot.*, R. Ser., iv, 2, pp. 175–178, 1 fig., 1944.

In recent years, Egyptian clover (*Trifolium alexandrinum*) has been increasingly affected in Palestine, where it is one of the chief forage crops, by a leaf and stem

spot which leads to a drying-up of the whole plant. The spots first appear on the lower leaf surface as small, round, dark brown lesions, usually surrounded by a yellow halo. As they enlarge, they are also seen on the upper leaf surface; the centres are light brown and dry and sometimes show concentric zones, while the edge remains dark brown, and there is no halo. The spots first appear at the tip, along the veins, and in the centre of the leaf. Individual spots may coalesce and cause the leaf to dry up. On the stems, the spots are more elongated and may unite to cover the whole stem. Sometimes they penetrate some distance into the stem, splitting the outer tissues, and producing a canker-like lesion.

The black, more or less globose pycnidia, measured 90 to 150 μ in diameter, while the two-celled, hyaline spores, rounded at the ends and generally slightly constricted at the septum, measured 15 to 20 by 3 to 5 μ . In 150 samples from 22 localities throughout Palestine, the spores were never found to contain more than one septum; the young spores sometimes showed only one cell. The fungus is provisionally identified as *Ascochyta trifolii* [R.A.M., xvii, p. 440]. Perithecia of *Sphaerulina* sp. were frequently found in association with the pycnidia of *A. trifolii*.

DILLON WESTON (W. A. R.) & TAYLOR (E.). **Some observations on powdery mildews.** -*Trans. Brit. mycol. Soc.*, xxvii, 3-4, pp. 119-120, 4 figs., 1945.

Overwintering in the form of dormant mycelium has been shown to be the primary means of hibernation of apple mildew (*Podosphaera leucotricha*). Oak mildew (*Microsphaera alni* var. *extensa*) perennates in this way as, it is stated, does *Sphaerotheca pannosa* on peach. In a Cambridge garden it has been observed that when hawthorn hedges have been neglected and left untrimmed, *P. oxycanthae* appears early in the season on young leaf and flower shoots and that these are evenly mildewed all over. When the hedges are cut in the autumn, mildew is negligible in the following year. The bush roses in the garden are carefully pruned and suffer but slightly, while the rambler roses, which receive less attention, are severely attacked by *S. pannosa*, especially where they grow under the shade of trees. Although heavily over-shaded, gooseberries pruned annually and not sprayed were nearly free from American gooseberry mildew [*S. mors-uvae*] for twelve years, but in 1943 pruning was not carried out and in 1944 mildew appeared in a virulent form on the berries. It is suggested that a thorough study should be made as to whether or not these mildews perennate wholly or partly by dormant mycelium in the bud.

SHAY (J. R.) & KEITT (G. W.). **The inheritance of certain mutant characters in *Venturia inaequalis*.** -*J. agric. Res.*, lxx, 2, pp. 31-41, 3 figs., 1944.

This is an expanded account of studies on the genetics of the apple-scab fungus, *Venturia inaequalis*, a preliminary account of which has already been noticed from another source [R.A.M., xxiii, p. 254]. The mechanism of inheritance in *V. inaequalis* appears to be essentially the same as that in *Neurospora crassa*, but minor changes of position of nuclei or spores are not infrequently encountered. All the characters studied were inherited independently except 'tan' and 'white', which were linked. The four mutant genes (white, tan, non-conidial, and small) and the sex-reaction factors have been located with respect to their centromeres.

The effects of a single mutation on the behaviour of the fungus may be profound. The white (W) mutant prevents the development of the characteristic dark pigment in the thallus, induces abortion of ascospores, and probably by interacting with modifying factors suppressed the expression of pathogenicity in the parent line. The mutant labelled 'small' is shown to suppress macroscopic expression of pathogenicity, though penetration of the host is accomplished and a microscopic subcuticular development occurs.

The demonstration that gene mutations are capable of complete or partial

suppression of pathogenicity emphasizes the importance of the elimination of modifying factors in the parental material before a genetical analysis of pathogenicity is attempted.

PERLBERGER (J.). **The occurrence of Apple and Pear scab in Palestine in relation to weather conditions.**—*Palest. J. Bot.*, R. Ser., iv, 2, pp. 157–161, 2 graphs, 1944.

Apple and pear scab (*Fusicladium dendriticum* and *F. pirinum*) [*Venturia inaequalis* and *V. pirina*] occur throughout Palestine, local varieties only, however, being affected. The European varieties of these fruits introduced into the country of recent years commence their seasonal growth four to six weeks later in the case of apples, and two to three in that of pears, than the local sorts, by which time the rains have usually ceased, the temperature is higher, and atmospheric humidity low. Under such conditions the spore-germination requirements of *V. inaequalis* [*R.A.M.*, vi, p. 299; xi, p. 50, et passim] are not fulfilled, and hence the freedom from infection of the foreign varieties is attributable rather to their escape from adverse meteorological factors than to any change in their inherent predisposition to scab.

COOLEY (J. S.). **Some host-parasite relations in the black root rot of Apple trees.**—*J. agric. Res.*, lxix, 12, pp. 449–458, 3 graphs, 1944.

When young apple trees in nursery rows were inoculated at monthly intervals from 1933 to 1935, inclusive, with *Xylaria mali* [*R.A.M.*, xxii, p. 69], in each year the percentages of infection rose in June, reached a peak in July (83 and 88 per cent. in 1934 and 1935, respectively), and declined to less than 10 per cent. in September. It was also found that susceptibility at any particular date may vary from season to season; thus, in August, 1934, infection was 57 per cent., whereas in August, 1935, it was only 9 per cent. If the soil temperatures followed the air temperatures during the period of the experiment, they should have been sufficiently high for infection in August and September, when the attacks were, in fact, moderately light. Earlier work [loc. cit.] having shown that *X. mali* infects apple trees much more readily when the host is in a low state of vigour than at other times, it would appear that susceptibility may be associated with a seasonal diminution in root activity rather than with some temperature change.

Experimental maltreatments of the trees at monthly intervals, including cutting the trunk more than half-way through and bending the top over, ringing the trunk, root-pruning, and summer-pruning of the branches, were carried out from April to August, roots being inoculated in July on trees treated up to that time and on untreated trees, and in August on trees maltreated in that month. The general trend of the results of maltreatment was a slight increase in the percentage of infected trees and in the size of the lesions, as compared with trees not maltreated. The greatest effect occurred when the treatments were applied in June and the inoculations effected in July. The evidence indicated that susceptibility to infection and the extent of the lesions are probably influenced by the seasonal activity of the trees.

In 1937, three-year-old Stayman Winesap trees worked on seedling roots were experimentally defoliated twice a month from 3rd May until 18th October, inoculations being made on 15th July and subsequently with each defoliation. Non-defoliated controls were similarly inoculated on the same dates. In 1938, the treatments were repeated, the inoculations being made on the opposite side of the trees; in 1939, no defoliations were carried out, but all the trees were inoculated in mid-July. The results obtained showed that, in general, defoliation slightly increased susceptibility to infection. Defoliation early in summer resulted in greater susceptibility and greater stunting of growth than defoliation effected in the latter part of the summer.

DUNEGAN (J. C.), ROBERTS (J. W.), & GOLDSWORTHY (M. C.). **Spray experiments with organic fungicides for the control of Apple bitter rot.**—*Plant Dis. Repr.*, xxviii, 34, pp. 1035–1037, 1944. [Mimeographed.]

During 1944, Ada Red apple trees growing in an orchard at Centerton, Arkansas, where the crop had been destroyed by bitter rot (*Glomerella cinzulata*) [*R.A.M.*, xxii, p. 487] in 1942 and 1943, were treated with Bordeaux mixture (4–6–100), four applications, fermate $1\frac{1}{2}$ lb. per 100 gals., eight applications, U.S. Rubber 604 (2, 3-dichloro-1, 4-naphthoquinone) 1 lb. per 100 gals., eight applications, and disodium ethylene bisdithiocarbamate (dithane, HE-175), zinc sulphate, hydrated lime, 1–1– $\frac{1}{2}$ lb. per 100 gals., eight applications. The total numbers of apples examined after the four treatments were, respectively, 15,098, 22,086, 23,415, and 16,798, together with 12,756 untreated controls, and the percentages of bitter rot were, respectively, 52.6, 29.3, 12.1, 72.6, and 89.8.

The reduction of infection to 12.1 per cent. in an orchard where the fungus had caused loss of the commercial crop in the two preceding seasons and destroyed nine-tenths of the crop on the control trees in the year of the test shows a very high degree of effectiveness against the bitter-rot fungus on the part of U.S. Rubber 604. Other workers have found this compound highly toxic to *G. gossypii*. The material caused, however, a definite superficial spotting of the fruit.

McCOLLOCH (L. P.). **A study of the Apple rot fungus *Phialophora malorum*.**—*Mycologia*, xxxvi, 6, pp. 576–590, 4 figs., 1944.

Further studies on *Phialophora malorum* [*R.A.M.*, xxii, p. 211], which causes serious loss in stored apples, showed that the fungus grew best on Thaxter's agar of unoxidized potato juice and 2 per cent. dextrose. The colour varied greatly according to the medium, and strain differences in the production of dark pigment were marked on Czapek's agar. Growth in culture appeared to be best between P_{II} 4.4 and 6. All strains produced oxidase though not at the same rate or intensity. Saltation occurred in respect of colour, texture, rate of growth, and physiological behaviour, and in one strain were considerable; the variations found justified the inclusion of all the isolates studied in the single species.

The conidia are extruded from single, terminal, sporogenous phialides which, typically, are short, one-celled, ampulliform, but often unsymmetrical, structures. They are swollen through the centre, taper at the base, and have a constricted neck and a flared cup at the apex, through which the conidia are formed. The first indication of sporulation is the constriction and elongation of the phialide apex. The first conidium ruptures the terminal wall, and is cut off and extruded. The ruptured end of the phialide is kept in the shape of a cup by the formation of succeeding conidia, eventually becoming rigid. Normally, the conidia are never borne within the phialide, but are formed through a pore at the base of the cup. The protoplasm from the mother cell within the phialide, surrounded by a membrane, grows out through the pore, and the developing conidium, seated in the open cup, grows to maturity. The spore wall then forms, and the spore separates from the mother-cell connexion, being pushed out of the cup by the development of the next conidium. The conidia are extruded continuously in a mucus-like substance until the cell contents of the phialide are exhausted. Conidia produced on the aerial hyphae are held in packets at the tip of the phialides by the mucus. When sporulation is copious, the masses appear as glistening globules.

Excluded from *Sporotrichum* by the dark colour in the hyphae, the poor to moderate hyphal branching, and the mode of conidial formation, the fungus has been designated *Phialophora malorum* (Kidd & Beaum.) McCulloch [loc. cit.], syn. *Sporotrichum malorum* and *S. carpogenum*. The amended description states that it shows hyaline, later fuscous to brown, septate, moderately branched hyphae

1 to 4 μ in diameter, terminal and intercalary chlamydospores, typically vase-shaped conidiophores composed of specialized sporogenous cells, measuring 5 to 10.8 μ long and arising laterally, terminally, or in clusters from the hyphae, and hyaline to fuscous, subglobose to elliptical, unicellular conidia measuring 4.2 to 7.8 by 1.4 to 3.6 μ .

BOYNTON (D.) & BURRELL (A. B.). **Potassium-induced magnesium deficiency in the McIntosh Apple tree.**—*Soil Sci.*, lviii, 6, pp. 441–454, 1944.

Magnesium deficiency leaf blotch was induced in McIntosh apple trees growing on an acid soil low in exchangeable bases in the Champlain Valley, New York, by the application of muriate or sulphate of potash fertilizers over a period of three years or more [*R.A.M.*, xxiii, p. 443]. The appearance of the symptoms was accompanied by a decrease in the magnesium content of the leaves and an increase in that of potassium, and orchard and greenhouse studies pointed to the competitive effect of the latter element at the root surface or within the tree as the primary cause of the necrosis. The potash treatment further resulted in an increase of exchangeable potassium and a corresponding decrease of exchangeable magnesium in the surface soil below the trees. Twelve years of spraying, mostly with wettable sulphurs, combined with annual applications of ammonium sulphate, brought about a marked acidification of the soil, expressed by a drop in P_{H} from 5.7 to 4.3 under some of the trees suffering from magnesium deficiency leaf blotch.

KIENHOLZ (J. R.). **Mycosphaerella tulasnei in Apple and Pear orchards.**—*Mycologia*, xxxvi, 6, pp. 648–649, 1944.

After pointing out that the relationship between *Cladosporium herbarum* and *Mycosphaerella tulasnei* was confirmed by Ruehle [*R.A.M.*, xi, p. 310], the author states that perithecia have commonly been observed in the spring on overwintered apple and pear leaves at Hood River, Oregon, since 1932. Less often, partly developed perithecia were found developing in scurfy areas below buds on pear shoots which had grown rapidly during the past season. Typical *C. herbarum* cultures were obtained from ascospore isolations of this material, and perithecia were again produced from cultures on sterilized wheat, apple, and pear leaves in culture.

Measurements of fresh, naturally occurring fruiting bodies from overwintered apple and pear leaves gave perithecia 100 to 160 μ wide by 150 to 250 μ deep, immersed in the leaf tissue from $\frac{1}{4}$ to $\frac{1}{3}$ of their depth, present on either leaf surface not in contact with the soil; asci, 32 to 107 by 11 to 27 (mean 67.2 by 17.4) μ ; and ascospores, typically 2-celled, 11 to 29 by 4 to 9 μ , mean 21.6 by 7.9 μ (top cell) to 6.4 μ (bottom cell), hyaline to pale olivaceous-brown when older. The mean measurements for 3- and 4-celled ascospores were, respectively, 25.5 by 8 and 28.3 by 8.5 μ . The ascospores generally became 3- to 4-celled when germinating. Conidia produced in culture or on fruit tissue were variable in shape, almost globose to narrowly ellipsoid, 1- to 3-celled, up to 30 μ long, and with a finely echinulate spore wall.

WILLISON (R. S.). **Strains of Prune dwarf.**—*Phytopathology*, xxxiv, 12, pp. 1037–1049, 2 figs., 1 diag., 1944.

Symptomatological evidence is presented in support of the author's opinion that four viruses under investigation in Ontario, two on plum and two on cherry, are strains of the prune [plum] dwarf virus [*R.A.M.*, xxiii, p. 492], differing in virulence. Strain 1 was obtained from Italian prune grafted on Damson; 2 from an unknown blue prune variety showing marked dwarf symptoms after top-working on Damson; 3 (the agent of Elkhorn cherry ring spot [*ibid.*, xxii, p. 142]) from a tree of this variety bearing on the leaves small, circular lesions, often with necrotic centres, and larger rings and blotches, and on the fruits minute, sunken

areas and internal brown spots; and 4, responsible for Eagle cherry mottle [loc. cit.] from an unfruitful Black Eagle tree with an inconspicuous foliar mottle.

All four strains were transmitted, by double-budding of the current year's growth and two-year nursery stock and by direct inoculation of the latter, to the Italian and German prune varieties, Lombard and Reine Claude, Montmorency and Napoleon cherries, Niagara apricot, and *Prunus mahaleb*. Grand Duke plums reacted to strains 1 and 2 (the only ones used on this variety) by leaf markings (transient in the former case), while in Abundance (*P. salicina*) the effects of strain 2 were mild and those of the others doubtful. On Black Tartarian cherry strain 3 was symptomless and the foliar markings of strain 1 faint or absent. The response of Black Eagle Cherry was indefinite in regard to strains 1, 3, and 4, and the symptoms induced by 2 were slight. The supposedly healthy Elkhorn cherry, which was scarcely affected by strains 1 to 3 (4 was not used), was found to be already harbouring the prune dwarf virus. In myrobalan [*P. divaricata*] strain 2 was the only one to induce noticeable symptoms in the shape of chlorotic mottling, lines, rings, and sometimes dwarfing. On Italian prunes and Lombard plums all strains induced typical strap-shaped, rugose, thickened foliage and their growth was stunted; peaches were also stunted and bore leaf markings of various types; while on cherries and *P. mahaleb* the foliar patterns assumed the forms of rings, lines, and oak leaves.

A tendency to recovery after the appearance of the initial 'shock' symptoms was observed in peaches and cherries.

HILDEBRAND (E. M.) & WEBER (P. V.). Varietal susceptibility of Currants to the cane blight organism, and to Currant mosaic virus. *Plant Dis. Repr.* xxviii, 34, pp. 1031-1035, 1944. [Mimeographed.]

Preliminary inoculation studies carried out in 1941 with the currant cane-blight fungus (*Botryosphaeria ribis*) demonstrated wide variation in the virulence of different strains. In 1942, one highly virulent culture was selected for studying the resistance or susceptibility of 55 different varieties of currants, and the results [which are tabulated] showed much variation in resistance and susceptibility. Thirty-eight of the varieties were found to be susceptible after the first test; the remaining 17 were then inoculated, whereupon only three became infected. When the 14 non-susceptible varieties were reinoculated a year later, they all remained unaffected. Breeding for resistance would appear to be quite possible.

Of the same 55 varieties, 35, or 63·6 per cent., were found to be susceptible to currant mosaic [*R.A.M.*, xviii, p. 536]. A peculiar crinkle of unknown origin was noted on four varieties, of which three were susceptible to mosaic and one not. The new commercial variety, Red Lake, did not appear to be susceptible to mosaic.

CALAVAN (E. C.). The use of eradicant and blossom sprays on sour Cherry in the control of brown-rot blossom and spur blight incited by *Sclerotinia laxa* Ader. and Ruhl.—Abs. in *Phytopathology*, xxxiv, 12, p. 997, 1944.

During the past two years, effective control of brown rot (*Sclerotinia laxa*) in the blossom- and spur-blight phases has been obtained in Door County, Wisconsin, by the application, shortly before bud-break, of a copper-lime-monocalcium arsenite and fish oil (3·2-2-1½ pints-50) eradicant spray, supplemented in early bloom by a protectant treatment of 3-4 50 Bordeaux mixture. During the wet spring of 1943 these sprays reduced the spurs blighted from 52·7 to 0·5 per cent. Either treatment alone was less satisfactory. Estimated reductions in percentages of total spurs blighted for trees receiving the dormant spray only, the blossoms spray only, and both applications were 97·5, 82·1, and 99·1, respectively. In 1944, the absence of infection periods until most petals had fallen resulted in only a small number (2·8 per cent.) of blighted spurs on the unblighted controls, and

under these conditions the dormant, blossom, and both sprays reduced the incidence of infection by 50, 60, and 92 per cent., respectively.

SCARSETH (G. D.). **Reported control of Panama disease.**—*Daily Gleaner*. Kingston, Jamaica, 25th January, 1945.

In this newspaper report of experiments made in Honduras by the Standard Fruit Company, La Ceiba, it is stated that the removal of banana mats infested by Panama disease (*Fusarium bulbigenum* [oxysporum] *cubense*) [R.A.M., xiv, p. 378] resulted apparently after eight or nine years in a partial natural disinfection of the soil, the disease on such land being considerably retarded. A new series of trials was initiated in 1937 with this idea of biological disinfection as a basis. Strongly acid, light clay soil, cleared of living banana mats 12 years earlier, was given heavy applications of lime (12 to 15 tons per acre), worked into the top 5 to 8 in., to counteract the known adverse effects of undue acidity. Phosphate and potash were added and the ground planted with legumes, e.g., *Crotalaria* or velvet bean [*Stizolobium deeringianum*], several such crops being forked under in the course of a year or two before planting Gros Michel bananas. Some of these tests were more successful than others, and further large-scale operations, besides confirming the need for a lengthy period (10 to 12 years) of abandonment after the clearance of infested soil, emphasized the importance of turning under large quantities of organic matter. It has recently been ascertained, moreover, that the depth to which lime is incorporated with the soil is also an important factor. On a plot where calcium hydrate (preferable to calcium carbonate) was added to a depth of 2 ft. and the other above-mentioned requirements fulfilled, not a single case of Panama disease appeared in two years and five months, whereas a neighbouring untreated site showed 96 per cent. infection, which began to develop five months after planting. Clay soil should be selected for experimental trials of this method, and sufficient hydrate of lime should be added to obtain a P_H value of 7.5 to a depth of 16 to 24 in., requiring perhaps 12 to 15 tons per acre. Several leguminous crops should be ploughed in over a period of one or more years before replanting with banana.

NORRIS (D. O.). **The evaluation of D.D.T. as a fungicide.**—*J. Coun. sci. industr. Res. Aust.*, xxvii, 4, pp. 289–290, 1944.

Tests are reported of the possible fungicidal properties of D.D.T. (dichlorodiphenyltrichlorethane) on cultures of *Ophiobolus graminis*, *Colletotrichum trifolii*, *Pleospora herbarum*, *Ascochyta imperfecta*, and *Pseudoplea trifolii*, as a disinfectant for peas against damping-off, and for wheat against *Urocystis tritici*. The results showed that D.D.T. possesses no value whatever as a fungicide.

PALTI (J.) & MOELLER (S.). **Overhead application of fungicidal sprays (preliminary experiments).**—*Palest. J. Bot.*, R. Ser., iv, 2, pp. 184–192, 1944.

About one-half of the area under vegetables in Palestine is irrigated by overhead irrigation systems, and there are large areas of other crops in which the same method is employed. Much labour would be saved if the overhead pipes could be used for spraying. Besides, less damage would be done to the crops and the spraying could be done frequently and, if necessary, immediately after rain. On the other hand, a larger amount of material would be used and the under side of the leaf would be liable to remain unsprayed.

In comparative tests on small plots of potatoes for the control of *Alternaria* blight [*A. solani*] with 2 per cent. floridan the overhead treatment gave a yield of 1.08 times the untreated control, while the ordinary method gave 0.93 times. The corresponding figures for 1.5 per cent. cita California spray against powdery mildew of potatoes [*Oidium* sp.] were 1.17 and 1.11, for 1 per cent. floridan against

cucumber downy mildew (*Peronoplasmopara* [*Pseudoperonospora*] *cubensis*) 4.29 and 4.82, and for 1.25 per cent. floridan against the same disease 10.21 and 7.18, respectively. The rate of application of sprays by the overhead system was two or three times that of the ordinary system, but this drawback is considered to be outweighed by its many advantages.

BOOER (J. R.). **The behaviour of mercury compounds in soil.** —*Ann. appl. Biol.*, xxxi, 4, pp. 340–359, 5 figs., 4 graphs, 1944 [1945].

Studies conducted by means of a pot technique [which is described] demonstrated that when any mercury compound used in plant pathology is applied to the soil it decomposes into metallic mercury. Where the chloride ion is involved, the governing factor is the rate of decomposition of mercurous chloride. With other inorganic compounds of mercury direct reduction to the metal takes place. With the organo-mercury compounds, the rate of decomposition of the organo-mercury clay is probably the governing factor. The effects of mercury, while not permanent, may persist for a considerable time. Mercury is not a cumulative soil poison. It is not eliminated, but is rendered harmless by the formation of mercuric sulphide, probably as a result of bacterial action. The addition of sulphur to the soil appears to be the best way to purify it after it has been treated with mercury.

GARRETT (S. D.). **Root disease fungi. A treatise on the epidemiology of soil-borne disease in crop plants, and a first exposition of the principles of root disease control.** —vi + 177 pp., 1 pl., 7 figs., 1 diag., Waltham, Mass., The Chronica Botanica Co.; London, William Dawson & Sons, Ltd., 1944. \$4.50.

In this interesting book, much information on root-infecting fungi has been brought together in a convenient and stimulating form. The work 'is not intended to be a text-book and no attempt has been made to deal comprehensively either with all root-infecting fungi, or with the diseases they cause'; instead, attention is focused on 'a comparatively small number of fungi causing diseases of notable economic importance'. After an introductory chapter, six chapters are devoted to the parasitic and saprophytic activity of root-infecting fungi and the effects of soil factors. The second half of the book is given up to discussions on the control of root diseases in field crops (three chapters), plantation crops (three chapters), and glasshouse crops (one chapter), and concludes with a 16-page bibliography and indexes.

ARMITAGE (F. D.). **Chlorazol black as a stain for mycological specimens.** —*Trans. Brit. mycol. Soc.*, xxvii, 3–4, pp. 131–153, 5 figs., 1945.

Directions are given for the use of chlorazol black E as a stain for fungi. The dye can be added to lactophenol mixtures for use as temporary mounts. Sufficient dye is added to produce a dense, black solution and is allowed to stand two or three days before filtering for use. Permanent slides can be prepared by using a saturated stain in 70 per cent. ethyl alcohol or better still absolute methyl alcohol, the stain being allowed to act for at least three hours and the excess stain removed by washing in 70 per cent. alcohol before mounting in euparal. Dioxan-diethylene dioxide can be used as a dehydrating agent for specimens stained in alcoholic chlorazol black E.

HOOGERHEIDE (J. C.). **Antibiotic substances produced by soil bacteria.** —*Bot. Rev.*, x, 10, pp. 599–638, 1944.

After a brief introductory survey of the development of interest in antibiotic substances *inter alia* as therapeutic agents in soils, the author gives a detailed account, with numerous references to the relevant literature, of gramicidin [*R.A.M.*, xxi, p. 248] and tyrocidine, isolated from *Bacillus brevis* [loc. cit.], actinomycin A

and B, isolated from *Actinomyces antibioticus* [loc. cit.], streptothricin [loc. cit.], excreted by *A. lavendulae*, and other antibiotics. A bibliography of 145 titles is appended.

RABOLD (C. N.). **War lends impetus to proofing finishes.**—*Text. World*, xciv, 8, pp. 90–92, 4 figs., 1944.

Three types of finishes on cotton fabrics have been used in immense quantities by the military services since the outbreak of war, namely, flame-, mildew-, and water-proofing. Fungicides supplied to the army for the prevention of mildew damage [*R.A.M.*, xxiii, p. 71 *et passim*] include ortho-phenylphenol, 2-chlor-ortho-phenylphenol, salicylanilide, pentachlorophenol, 2, 2-dihydroxy-5, 5-dichlor-diphenylmethane, copper naphthenate [ibid., xxiii, p. 266; xxiv, p. 158], copper oleate, cuprammonium hydroxide, cuprammonium fluoride, zinc dimethyl dithiocarbamate, phenyl mercury acetate, phenyl mercury oleate, alkyl dimethyl benzyl ammonium salts, and amino-guaiacol benzothiazole imino-urea. Various drawbacks attach to all these substances, some connected with difficulties of application by the solvent solution and single- or two-bath methods, and others with the toxicity of the chemicals to the finishers, their disagreeable odour, unattractive colouring, insufficient durability, and the like. At the present juncture some of these defects are of little importance, but they are likely to assume greater prominence under post-war conditions.

MEYER (J. R.). **Ação benéfica dos transplantes para o desenvolvimento de Orquídeas em meios nutritivos assimbióticos.** [The beneficial action of transplantations on the development of Orchids in asymbiotic nutrient media.] —*Biológico*, x, 11, pp. 374–376, 2 pl., 1944.

Excellent results were obtained by three or four annual transplantations of orchid seeds of the varieties *Cattleya schilleriana*, *C. citrina*, *Laelia purpurata*, *L. blackii*, *L. cinnabarina* and its var. *elegans*, and *Rodriguesia renusta* to fresh tubes of a modified Sladen's or the author's tomato juice medium [*R.A.M.*, xxiii, p. 403] at 18° to 22° C. The plants thus treated were larger, darker-coloured, and provided with better-developed roots than those left in the original tubes for comparable periods.

JACOB (F. H.). **A two years' survey of the Potato aphides in the Northern Agricultural Advisory Province.**—*Ann. appl. Biol.*, xxxi, 4, pp. 312–319, 1 map, 1944 [1945].

After pointing out that efforts to maintain virus-free stocks of potatoes depend largely on the successful isolation of the potatoes from insect vectors, and that such isolation depends on geographical, climatic, and biological factors, the author states that of these factors the biological ones are fundamental, since it is only by studying them that the significant geographical and climatic factors can be determined. Details are given of a survey made during 1942 and 1943 in the Northern Agricultural Advisory Province of the potato aphids, *Myzus persicae*, *M. pseudo-solani*, and *Macrosiphum solanifolii* [*M. gei*], with special reference to overwintering and the weather conditions prevailing at the time of the spring migration. It is tentatively concluded that provided districts are selected that are well isolated from the sources of spring infestation, there would appear to be large areas well suited to the maintenance of healthy seed potatoes in Cumberland, Westmorland, and the more hilly western parts of Northumberland and Durham.

NATRASS (R. M.). **A new bacterial disease of the Potato in Kenya.**—*E. Afr. agric. J.*, x, 3, pp. 162–163, 2 pl., 1945.

Brown rot caused by *Bacterium* [*Xanthomonas*] *solanacearum* is well known in

Kenya, but a new disease has appeared with symptoms apparently identical with ring rot (*Corynebacterium sepedonicum*), though attempts to demonstrate a Gram-positive organism have so far failed and the identity of the pathogen remains in doubt. From comparison with a culture of *C. sepedonicum* received from Dr. L. C. Knorr, however, the author concludes that the Kenya ring-rot organism cannot be identified with that species. The exudation of whitish, putty-like masses of bacteria from the cut tuber surface characteristic of *C. sepedonicum* was observed. In advanced stages the bacterial masses can be seen embedded in the tissue even though no external sign of disease may be apparent. Wilting and yellowing of the leaves, another symptom induced by *C. sepedonicum*, was present and wilting was induced by inoculation through needle pricks. The disease is not apparently carried over in the soil, but in Kenya where volunteer plants are so persistent it will not be easy to eradicate. Control measures recommended are the use of healthy seed and the disinfection of all material used in handling the crop.

SMALL (T.). **Dry rot of Potato (*Fusarium caeruleum* (Lib.) Sacc.). Investigation on the sources and time of infection.**—*Ann. appl. Biol.*, xxxi. 4, pp. 290-295, 1944 [1945].

In investigations carried out in Cheshire into potato dry rot (*Fusarium caeruleum*) [*R.A.M.*, xxiii, p. 242], inoculations of healthy tubers with soil samples from tubers taken from 12 Cheshire farms in the field at digging time before the potatoes came into contact with any other source of infection, such as hampers or sacks, from farmers' own seed stored in boxes in lofts two to three weeks after lifting in July, and before any dry rot appeared, from healthy seed in boxes during winter, and from sacks of seed from Scotland and Northern Ireland stored in warehouses, showed that almost every soil sample tested was contaminated. The fungus appeared to be widely distributed in Cheshire soils: in four cases, potatoes had not been grown in the soil for five or six years, and in one for nine years. The fungus was ascertained to be viable in soils with P_{H_2} values between 5.25 and 6.74.

In trials made on eight farms in 1942 and again in 1943, using the farmers' own saved seed, the tubers were lifted with a spinner in July and at digging time were placed in boxes, or were 'standard' bruised and placed in boxes. One-half of each series, bruised and unbruised, were dipped for one minute in a proprietary organo-mercury preparation. Dry rot appeared in September. In October, the affected tubers (few in the unbruised, undipped series, but numerous in the bruised, undipped) were discarded, and 40 tubers bearing spore pustules were placed in contact with the healthy tubers remaining in each box. In February, the increase in dry rot in the dipped, undipped, and control boxes was negligible. The costly and laborious procedure of regularly examining seed potatoes and rejecting affected ones would appear to be unnecessary in areas where the growers lift and store their own-grown seed in boxes.

In laboratory tests, one diseased tuber was cut, and the knife then used to cut eight mature seed consecutively: six tests were made, and the 96 half tubers stored in a damp chamber. The controls, cut with a sterile knife, remained healthy. Forty-two of the other halves developed dry rot, a sevenfold increase. In the six tests, the disease was spread up to the fourth to eighth tuber. Treatment of the half tubers with an organo-mercury preparation immediately after cutting did not adequately check the disease. Contaminated knives may cause serious loss when cutting is done several weeks before planting, but where cutting is delayed until planting the result depends on the rate of disease development and plant establishment.

Other work demonstrated that contaminated seed boxes may be a source of infection, especially if the tubers are bruised. The small losses sustained among washed, bruised tubers in new boxes suggested that little, if any, infection occurs

before lifting. In one test with about 500 freshly dug tubers, removal of the soil by washing reduced dry rot from 20.7 to 3.1 per cent., and in another from 10.4 to 0 per cent. Mature wounded and unwounded tubers became infected when placed in contact with contaminated soil, while infection also occurred when mature, inoculated tubers were buried in soils with a wide range of temperature, moisture, and P_H values.

In the author's opinion, where the field soil is contaminated this is the main source of infection. Little if any benefit is to be expected from cleaning hampers, boxes, lofts, and sacks, as these will soon become recontaminated.

PERSON (L. H.). **A *Pythium* tuber rot and wilt of Irish Potatoes.**—Abs. in *Phytopathology*, xxxiv, 12, p. 1010, 1944.

During a spell of cool weather following heavy rain in the spring of 1941. Katahdin and Triumph potatoes in Louisiana were attacked by a sudden wilt of the aerial organs and tuber rot. Isolations from the tubers, the consistency of which was firm and their interior of a smoky grey colour, yielded cultures identified as *Pythium debaryanum*. Inoculations with this material induced a decay similar to that observed in the field and quite distinct from pink rot (*Phytophthora erythroseptica*) [*R.A.M.*, xx, p. 32], which was used in parallel tests. The *Pythium* rot appears to differ from other forms of tuber disorganization known in the United States, being comparable in some respects to the disease caused by *P. butleri* in Cyprus [*ibid.*, xvi, p. 20].

LITTAUER (F.). ***Sclerotium bataticola* (Taub.) Butler on Potatoes in Palestine.**—*Palest. J. Bot.*, R. Ser., iv, 2, pp. 142–147, 2 figs., 1944.

Infection of potatoes by *Sclerotium bataticola* [*Macrophomina phaseoli*: *R.A.M.*, ix, p. 561] in Palestine assumes three different forms, viz., stem blight and root rot, dry stem-end tuber rot, and black or charcoal tuber rot. In the first the whole plant suddenly turns yellow and later withers. The stem cortex sloughs off, exposing a dry, greyish xylem, and the pith is partly destroyed and filled with whitish, later black, sclerotia. These bodies are also found on the roots and stolons. In dry stem-end tuber rot, a black, sunken area develops round the stem end of the tuber. A cavity about 10 mm. deep, filled with collapsed tuber tissue, black sclerotia, and greyish, cottony mycelium, forms under the epidermis, being separated from the healthy tissue by a layer of suberized cells. The rot generally remains localized, and in most cases the stolon is also affected. In charcoal tuber rot, black spots 2 to 3 mm. in diameter encircle the light-coloured lenticels. The skin is unaffected, only the flesh beneath it being blackened. When the skin with the lenticels is peeled off, the spots in the flesh appear uniformly black. The spots are granulate and extend into the flesh to a depth of 2 mm. A soft rot, probably due to secondary bacteria, develops from these spots, and the tuber disintegrates. Even slightly affected tubers are unfit for culinary or seed purposes.

These diseases are widespread in Palestine, but attack is limited to crops grown in late spring. All the varieties at present grown are affected. Stem blight is not very frequent, but whenever it appears the losses are severe. Tuber rot is widespread and may cause very considerable damage, up to 5 per cent. of the tubers being affected at lifting and up to 50 per cent. losses occurring in storage.

In culture, the optimum temperature for sclerotial development ranged from 25° to 35° C. In inoculation tests, the fungus failed to cause infection even in wounded tubers at 25° to 40°, but when the tubers were heated for two hours at 55°, subsequent inoculations succeeded.

Control consists in avoiding high soil temperatures during the growth of the spring crop by the use of early varieties, early sowing and lifting, the choice of suitable and not excessively light soil, and frequent irrigation until shortly before

lifting. When lifted, the tubers should at once be placed in cool sheds and all those affected by disease, wounds, or heat discarded. The crop should then be stored in cold storage or in as cool and dry a store as possible. Storage in dry sand will reduce the risk of infection by contact.

PALTI (J.) & MOELLER (S.). **Trials for the control of powdery mildew on Potatoes.**—*Palest. J. Bot.*, R. Ser., iv, 2, pp. 148–156, [1944].

Potato powdery mildew (*Oidium* sp.) was first recorded in Palestine in an epidemic form in the autumn of 1941, again in the spring of 1942, and then in the spring and autumn of 1943. It has been widely prevalent in the northern parts of the country, in Galilee, the Jordan Valley, and the Valley of Esdraelon, but seldom found in southern Palestine. The symptoms generally appear first on the haulms, leaf stalks, and leaf veins, and consist of brown lesions of various sizes bearing minute, dark brown stripes. As the disease progresses a whitish covering appears on the lesions.

Experimental evidence demonstrated that sulfinette and citra lime-sulphur sprays used at 1.5 per cent. strength almost entirely suppressed the disease. The sulphur spray spersal, in combination with perenox, was also effective. In one test, Gaza sulphur (extra fine grade) gave equally satisfactory results. Bordeaux mixture, perenox, and cuprogreen concentrated had much less effect, though the addition of light-medium white oil to perenox slightly increased its effectiveness. The application of lime-sulphur sprays through the overhead irrigation system in one trial checked the disease as successfully as did applications by the usual methods. Lime-sulphur at 1.5 per cent. produced slight foliage scorching. It is recommended that treatments should start when the first symptoms appear, and should be repeated at intervals of 10 to 14 days until three to four weeks before lifting. Powdery mildew reduces yield only when infection occurs during the first two months of growth, when yields may be reduced by 20 per cent. or more, and grade composition be adversely affected.

KRAMER (M.) & FRANCO DO AMARAL (J.). **A identificação da 'murcha bacteriana' presente em culturas da Batatinha do Estado de São Paulo.** [The identification of 'bacterial wilt' present in Potato crops in the State of São Paulo.] *Biológico*, x, 7, pp. 199–207, 2 pl., 1944. [English summary.]

A description is given of bacterial wilt of potatoes (*Phytomonas* [*Xanthomonas*] *solanacearum*), based on field observations and laboratory experiments in São Paulo, Brazil [*R.A.M.*, xvii, p. 57]. The disease has also been reported from Rio Grande do Sul, Minas Gerais, and Paraná. Positive results were given by inoculation tests on potatoes and tomatoes, both by planting in soil with an admixture of crushed infected potato tubers and stems and by the introduction of the bacterial exudate into the stems through needle punctures. In a test in which eight tubers each of Eigenheimer and Konsuragis were planted in pots of infested soil on 11th November, 1943, 87.5 per cent. wilt developed in the course of the next two months, the corresponding figures for the same two varieties and Bintje (12 tubers of each) planted in the field on the same date being 75, 42, and 25 per cent., respectively. The causal organism was recovered from the diseased plants.

Botanical and Mycological Department.—*Rep. Rubb. Res. Bd Ceylon*, 1943, pp. 5–12, 1944.

This report [cf. *R.A.M.*, xxiii, p. 148] quotes the statement of an observer that during 1943 the attack of *Oidium* disease of rubber [*O. heveae*] in the Matale district of Ceylon was the worst yet experienced there. Infection was also severe in Uva and Moneragala. In the wet, low-country areas there was a sharp attack during

the main refoliation season, which on many estates caused a substantial loss of foliage. In some localities, late-wintering clones were also severely attacked.

In low-country districts, damage caused by *Diplodia* die-back [cf. *ibid.*, xxi, p. 97] of young budded trees affected by *O. heveae* was unimportant, but on one estate at 1,000 to 1,500 ft., 10 per cent. of the trees were affected and 2 per cent. had died down to the main stem. The outbreaks appeared to follow on a weakened condition resulting from severe infection by *O. heveae*.

Secondary leaf fall due to *Phytophthora palmivora* was less severe than in 1942, but it led to loss of foliage on many low-country estates during the south-west monsoon. Die-back of green shoots of young budded plants, caused by the same fungus, was also found on some estates. The annual defoliation produced by *O. heveae* and *P. palmivora* in the chief country districts, while less spectacular than that due to *O. heveae* at higher elevations, undoubtedly exercises a serious cumulative effect on the health of the trees.

A severe outbreak of canker of the renewing bark of budded trees showed the existence of marked differences in clonal susceptibility. Experimental evidence demonstrated that regular application of the standard estate disinfectant at a higher concentration prevented further serious damage. It also appears that once the disease has passed its initial stages, painting with disinfectants is not likely to cure it, excision of the damaged bark being necessary to prevent further extension. A strain of *Phytophthora* was isolated from the affected bark of clone MK 3/2.

Pink disease (*Corticium salmonicolor*) was recorded on four-year-old buddings of clone Pilmoor B/84, reported to be susceptible from Java.

A serious outbreak of *Fomes lignosus* in a young replanted area, interplanted with cassava, was ascertained to have originated from old rubber roots, the cassava having helped the spread of infection to the young trees. Cassava can serve as a useful indicator of the presence of *F. lignosus* if the tubers are carefully inspected at harvesting, but if the disease is overlooked, successive plantings of cassava can lead to an alarming increase in spread.

Oidium leaf disease. The technique of sulphur dusting.—*Adv. Circ. Rubb. Res. Scheme Ceylon 22 (Suppl.)*, 5 pp., 1944.

The notes on the technique of sulphur-dusting against *Oidium* [*heveae*] disease of rubber embodied in *Adv. Circ. Rubb. Res. Scheme Ceylon 22*, and first published in 1934 [cf. *R.A.M.*, xiii, p. 801], are brought up to date in the present *Supplement*. In this it is stated that the importance of beginning the dusting early cannot be over-emphasized, because if the fungus is allowed unrestricted development from the first it becomes almost impossible to control it without very large quantities of sulphur. As regards dosage and intervals between applications, programmes should be kept very flexible. If an application at a pre-arranged rate does not show signs of controlling the fungus, it may be necessary to make the next one at a substantially increased rate and after a shorter interval. This may prove to be an economy in the end, by enabling the rate of subsequent applications to be reduced.

SMITH (N. R.) & DAWSON (VIRGINIA T.). **The bacteriostatic action of rose bengal in media used for plate counts of soil fungi.**—*Soil Sci.*, lviii, 6, pp. 467–471, 1944.

The acid media in common use for plate counts of soil fungi were compared with substrata of the same composition adjusted to a neutral reaction and with the addition of rose bengal at a concentration of 1 in 15,000. The best results were obtained with glucose-nitrate soil extract agar plus rose bengal, which eliminated all the Actinomycetes and most of the bacteria and reduced the spreading of fungal

colonies to a minimum. At P_H 4.2 the numbers of fungi on all the media tested were lower than at P_H 6.8 with the admixture of rose bengal, which may also be incorporated with peptone-containing substrata; the latter, however, permit the development of at least twice as many bacteria as the glucose nitrate-soil extract agar, while the fungal colonies are fewer and less sharply differentiated.

RAPER (K. B.) & THOM (C.). **New Aspergilli from soil.**—*Mycologia*, xxxvi, 6, pp. 555–575, 6 figs., 1944.

Full descriptions with Latin diagnoses are given of the following five new species and one new variety of *Aspergillus* isolated from southern or tropical soils, viz.: *A. janus*, *A. janus* var. *brevis*, *A. caespitosus*, *A. granulosus*, *A. panamensis*, and *A. sparsus*.

THOMPSON (L. C.) & BROWN (B. M.). **Laboratory brewing trials with varieties of Hops showing some resistance to Verticillium wilt.**—*J. Inst. Brew.*, N.S., xlii, 1, pp. 39–40, 1945.

In laboratory brewing trials in 1943 and 1944 of some Wye seedlings resistant to *Verticillium [albo-atrum]*: see above, p. 165] and two commercially grown Beltring Golden type varieties, the two Beltrings 1140 and 1147 and the Wye seedlings, OB53, OJ47, and OR55 were found to be acceptable to the trade.

MUNGOMERY (R. W.). **Report of the Division of Entomology and Pathology.**—*Rep. Bur. Sug. Exp. Stas. Qd.*, 1943–44, pp. 21–24, 1944.

During the year under review [cf. *R.A.M.*, xxiii, p. 149] gumming disease (*Bacterium [Xanthomonas] vasculorum*) of sugar-cane was observed only on nine farms at harvest time in the Hambledon area, and by June this number was reduced to two. The direct loss from gumming is negligible, but the indirect loss will remain considerable till the disease is eradicated from the districts concerned. In the usual gumming-disease resistance trial at Brisbane of the new seedlings from the Experiment Stations, Q. 10 and Q. 45 were apparently highly resistant while Q. 13 and Q. 42 showed only a few streaks.

Downy mildew (*Sclerospora sacchari*) is under control in the northern areas. At Mossman only one farm is known to be infected; at Hambledon twenty stools were rogued from one field before ploughing-out and no other outbreak has occurred: no diseased stools were seen at Mulgrave or in the Herbert River district. With the decline of the disease, arrangements have been made to return the susceptible variety P.O.J. 2878 to the approved variety lists for all Mackay mills and to propagate the Bureau seedling, Q. 45, which had been held in abeyance. Since it could not be absolutely certain that the disease had been eliminated, the whole district has been proclaimed a quarantine area within which permits are necessary for the transfer of P.O.J. 2878 plants. Several hundred permits for the planting of this variety in 1944 have already been issued. In the Bundaberg district there has been a very marked increase in the disease; 4,013 stools were found in 18,153 acres inspected, all on the red volcanic soil of the Woongarra district, the scene of previous severe outbreaks. Some of the increase can probably be attributed to inability of the farmers, on account of shortage of labour, to harvest or plough-out diseased blocks. A special effort has been made this year to prevent the standing-over of diseased cane. Two downy mildew resistance trials were conducted during the year. At Meringa, in tests mostly of new seedlings, B. 306, B. 235, C. 277, Badila, B. 294, B. 307, B. 233, Hind's Special, B. 254, S.J. 2, S.J. 4, B. 230, and N.G. 16 showed no infection. In the Bundaberg trial, B. 5, B. 30, I. 11, I. 15, Q. 13, Q. 27, Q. 42, Q. 47, 32-8560, and CP. 29/116 remained free from the disease.

Fiji disease infection has also increased considerably in the Bundaberg district,

6,000 affected stools having been found in the 18,153 acres inspected. Part of the increase is due to labour shortage which prevented the removal of diseased cane. Quarantine proclamation No. 16 prohibits the planting of P.O.J. 2578, P.O.J. 2725, and Q. 25, thus cutting down the list of approved varieties very drastically. Increased planting of vigorous and commercially resistant C.P. 29/116 should ease the situation, though this variety is liable to arrow and is rather low in sugar early in the season. In the Isis area the disease showed a marked decrease, only eight diseased stools being found on four farms, and in the Maryborough district no Fiji disease was found in Island Plantation, once one of the worst-infected places in Queensland. In the Moreton Mill area the disease is only prevented from getting out of hand by sustained inspections and roguing, combined with a close watch on the sources of plants. Virtually the only conclusion to be drawn from the Fiji resistance trial concluded during the year was the extremely high susceptibility of the Hawaiian canes 32-1063 and 32-3575.

The small amount of leaf scald (*Bact. [X.] albilineans*) in the northern mill areas is of little economic importance. Top rot (*Phytophthora [X.] rubrilineans*) occurred as usual throughout the State but, except in the far north, where it was somewhat more severe than usual, was not much in evidence. Mosaic disease, though fairly widespread, was nowhere concentrated: it has increased somewhat in the variety Comus, while in the Mackay district at Bundaberg two of the new varieties, Q. 25 and Q. 42, are rather susceptible and will have to be watched closely.

SILVEIRA (V. D.). **Notas fitopatológicas e micológicas VII, VIII.** [Phytopathological and mycological notes VII, VIII.]—*Bol. Soc. brasil. Agron.*, vii, 1, pp. 33-36; 2, pp. 95-100, 8 figs., 1944.

Speira heptaspora (Garov.) Sacc., characterized by longitudinally septate, obovate conidia, 50 to 60 by 25 to 30 μ , was collected in Minas Gerais, Brazil, on fragments of dead tissue of a Coccid, which it had enveloped in a profuse sooty coating.

Phaeoisariopsis [Isariopsis] griseola was the agent of a bean leaf spot in the same State. *Macrosporium [Alternaria] porri* caused the development of purple spots on onion foliage in Rio de Janeiro [*R.A.M.*, xxii, p. 509]. *Abelmoschus [Hibiscus] esculentus* leaves were attacked by *Cercospora hibiscina* in the Federal District.

Septoria oleandrina produced on oleander foliage at Petropolis, Rio de Janeiro, well-marked, irregular, sunken lesions with white centres and dark red margins. *Corticium salmonicolor* was found causing a stem canker on a two-year-old *Eucalyptus alba* tree at Rocha Leão, where a reforestation project is being carried out by the Leopoldina Railway Company. The same fungus had previously been observed on poplar in Baía in 1935.

Rose leaves in the Federal District were infected by *Actinonema [Diplocarpon] rosae*. Dead orchid rhizomes at the Coronel Pacheco Station were invaded by *Stemonites fusca*.

HIRSCHHORN (ELISA). **Revisión de les especies de Tilletia de la Argentina.** [Revision of the species of *Tilletia* of Argentina.]—*Rev. Mus. La Plata*, N.S., v, pp. 1-20, 3 pl., 3 figs., 1942. [English summary. Received November, 1944.]

This is a critical revision of the species of *Tilletia* occurring in Argentina, namely, *T. eremophila* on *Muhlenbergia asperifolia*, *M. disticophila* (a new host), *M. sp.*, and *Eragrostis eremophila*; *T. hypsophila* on *Stipa tenuissima* and *Piptochaetium montevidense* (a new host); *T. fusca* var. *patagonica* n.var., with golden-brown, globose, reticulate chlamydospores, 20 to 26, 23.5 to 26, or 21 to 23 μ in diameter on *Festuca bromoides*; *T. tritici [T. caries]* on summer and durum wheat and

Petkus rye; and *T. levis* [*T. foetida*] on summer wheat, *Triticum polonicum*, and rye [*R.A.M.*, xxi, p. 249].

Among the points discussed are the analogies between (a) *Tilletia hypsophila* and *T. hyalospora* and (b) *T. eremophila*, *T. muhlenbergiae*, and *T. decipiens* [*ibid.*, xvii, p. 841]; the morphological instability of *T. caries* and its resemblances to *T. secalis* and *T. triticea*; and the anomalies in the promycelial structure of *T. caries* and *T. foetida*.

The paper comprises a key for the determination of the species and is supplemented by a bibliography of 54 titles.

KARLING (J. S.). **Brazilian Chytrids. IV. Species of Rozella.**—*Mycologia*, xxxvi, 6, pp. 638–647, 28 figs., 1944.

A critically annotated list is presented of five monosporangiate species of *Rozella* [*R.A.M.*, xxi, p. 351], including *R. laevis* parasitic on *Pythium* sp. resembling *P. gracile* [*ibid.*, xxiv, p. 75] from soil and one polysporangiate species, *R. achlyae*, in the sporangia of *Achlya flagellata*, isolated in water cultures in Rio Negro.

VIÉGAS (A. P.) & TEIXEIRA (A. R.). **Alguns fungos do Brasil (Phycomycetos).** [Some fungi of Brazil].—*Bragantia*, S. Paulo, iii, pp. 223–245, 22 pl. (1 col.), 4 figs., 1943.

The following are among the records in this annotated list of Phycomycetes collected in São Paulo, Brazil: *Plasmodiophora brassicae* on cabbage, *Spongospora subterranea* on potato tubers imported from Holland, *Physoderma zeae-maydis* [*P. maydis*] on maize, *Albugo* [*Cystopus*] *bliti* on *Amaranthus* sp. [*R.A.M.*, xi, p. 75], *A. candida* [*C. candidus*] on radish and mustard, *A. [C.] ipomoeae panduratae* on sweet potato [*ibid.*, viii, p. 11], *Phytophthora citrophthora* on citrus, including lime and orange, *P. infestans* on Argentinian and European potato varieties, *Pythium debaryanum* on potato and *Myrciaria* [*Eugenia*] *jaboticaba* fruits, *Bremia lactucae* on lettuce, *Peronoplasmopara* [*Pseudoperonospora*] *cubensis* on Cucurbitaceae, including melon, *Peronospora effusa* on *Chenopodium hircinum*, *P. parasitica* on cabbage and broccoli, *Plasmopara halstedii* on *Ageratum conyzoides*, *P. viticola* on vine (*Vitis labrusca* var. *isabela*), *Empusa* [*Entomophthora*] *aphidis* on potato aphids, and *Empusa dysderci* on *Dydercus* spp., including *D. mendesi* and *D. ruficollis* [*ibid.*, xix, p. 148].

BOND (T. E. T.). **The 'phloem necrosis' virus disease of Tea in Ceylon. II. Field observations and effect on yield.**—*Ann. appl. Biol.*, xxxi, 4, pp. 300–310, 4 graphs, 1944 [1945].

After briefly discussing the difficulty of diagnosing tea phloem necrosis [*R.A.M.*, xxiii, p. 362] in the field, the author presents evidence indicating a frequency of at least 25 per cent. diseased bushes for the aggregate acreage of tea above 6,000 ft. in Ceylon. As regards diagnosis, the problem is to combine rapidity with accuracy. An average of half a minute or less is all that can be allowed for each bush in field work, so that diagnosis is virtually confined to the detection in the petiole of a few leaves picked from different parts of the bush. Advanced cases are readily recognizable, but others may be overlooked, and, on the other hand, 'false necrosis' [*ibid.*, xxii, p. 43] may increase the apparent incidence. In practice, three categories are recorded, healthy (H), suspect (S), and necrotic (N). The use of category S as, in fact, an early stage of the disease is justified by the high percentage (up to 95 per cent. in the experiments so far recorded) of suspected bushes that later became necrotic. In view of the difficulties of diagnosis, any record of incidence can only be an estimate of the situation when the record was made. Hence, in following the progress of the disease two methods are possible, one being to take the records as they stand, and the other to use the cumulative total of

necrotic and suspect bushes, treating all N and S records as of equal value. In this work the latter method was used in roguing experiments, while for most other purposes the actual percentage of N and S bushes was used.

The evidence obtained failed to demonstrate any general tendency for the yield of affected estates to decline. Two apparently representative estates showed a decline in yield from 1929 to 1930, followed by recovery four or five years later. The most severely affected fields in both show a decline in yield relative to the estate as a whole of not over 19 lb. of made tea per acre per annum or 3.3 per cent. of the mean yield during the past ten years. Emphasis is laid on the great variability in individual bush yields, and the conclusion is reached that the elimination of unproductive bushes and their replacement by a type which has so far remained unaffected, though possibly carrying the virus, will more than counteract the effect of the progressive deterioration of the necrotic bushes remaining.

The distribution of affected bushes is irregular, and the rate of spread in different areas highly variable, incidence sometimes doubling in periods ranging from 3½ years to under one year.

In two experiments, complete roguing of all N and S bushes at intervals of six months reduced the rate of spread to about one-third of that in the controls.

ATKINSON (NANCY). **The serology of the Tobacco mosaic virus.—The action of various salts and salt concentrations in the agglutination reaction.**—*Aust. J. exp. Biol.*, xxii, 4, pp. 231–236, 1944.

Tests were conducted in various concentrations of sodium chloride and a number of other salts and solutions in an endeavour to find the most suitable medium for studies on the serology of tobacco mosaic virus [*R.A.M.*, xxi, p. 425]. The serological optima and the end titre of the antiserum did not remain constant. The system appeared less susceptible to variations in technique in potassium phthalate or potassium malate than in sodium chloride solutions. The variation in the serological results is attributed, at any rate in part, to the nature of the antigen.

SMITH (K. M.). **Transmission by insects of a plant virus complex.**—*Nature, Lond.*, clv, 3928, p. 174, 1945.

Studies on tobacco rosette [*R.A.M.*, xx, p. 449] have shown that it consists of two undescribed viruses, for which the names 'vein-distorting' and 'mottle' viruses are suggested. The former cannot be transmitted mechanically, but is dependent upon an aphid vector, while the latter is easily transmitted by sap inoculation. All attempts to transmit the mottle virus by aphid vectors failed unless it was accompanied in the plant by the vein-distorting virus.

In one typical experiment, a White Burley tobacco plant infected with the mottle virus was colonized with *Myzus persicae*, the insects being removed after the requisite feeding period and colonized on 12 young tobacco seedlings, using five to ten aphids per plant. All 12 plants remained unaffected. The mottle plant was then infected by means of aphids with the vein-distorting virus, and in due course developed the rosette-virus complex. It was then once more colonized with virus-free aphids which, after feeding, were transferred to 12 tobacco seedlings, one aphid being placed on each. Nine of the 12 seedlings developed rosette.

When the aphid has picked up both viruses, it retains them both for long periods, and in successive transfers at intervals of 24 hours it can infect 20 plants consecutively without resort to a fresh source of virus. Once infected with the virus complex, the aphid, in a series of transfers, sometimes transmits either virus alone and sometimes the whole complex. It is suggested that other viruses which are apparently not insect-borne when alone may be so transmitted in the presence of another virus.